OL. XXIII. — N° 7.

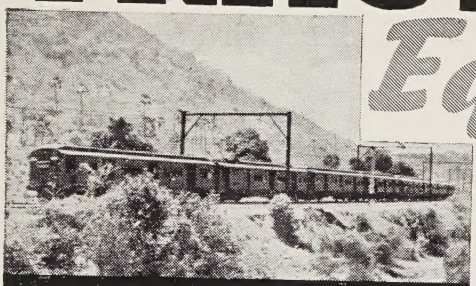
OCTOBER 1946

Monthly Bulletin of the International Railway Congress Association

(English Edition)

'ENGLISH ELECTRIC'

TRACTION *Equipment*



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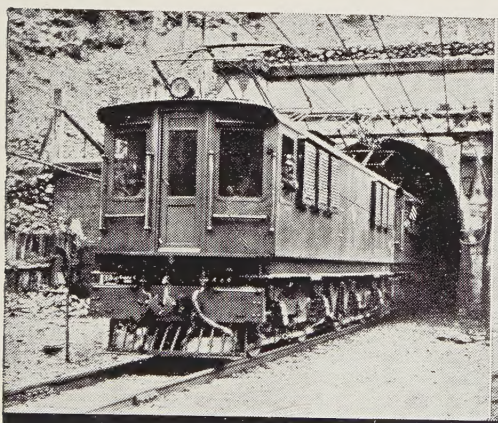

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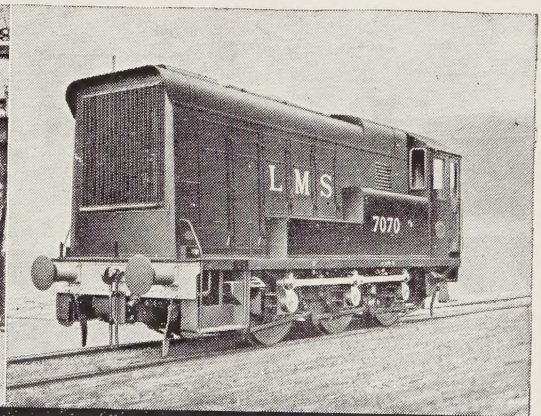

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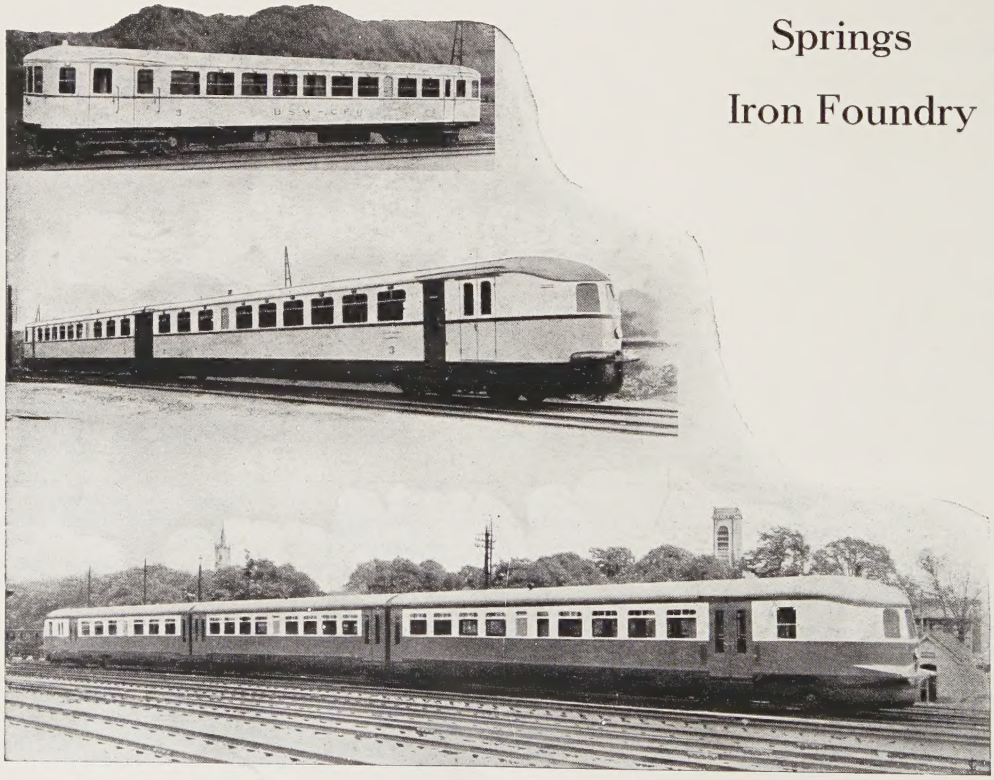

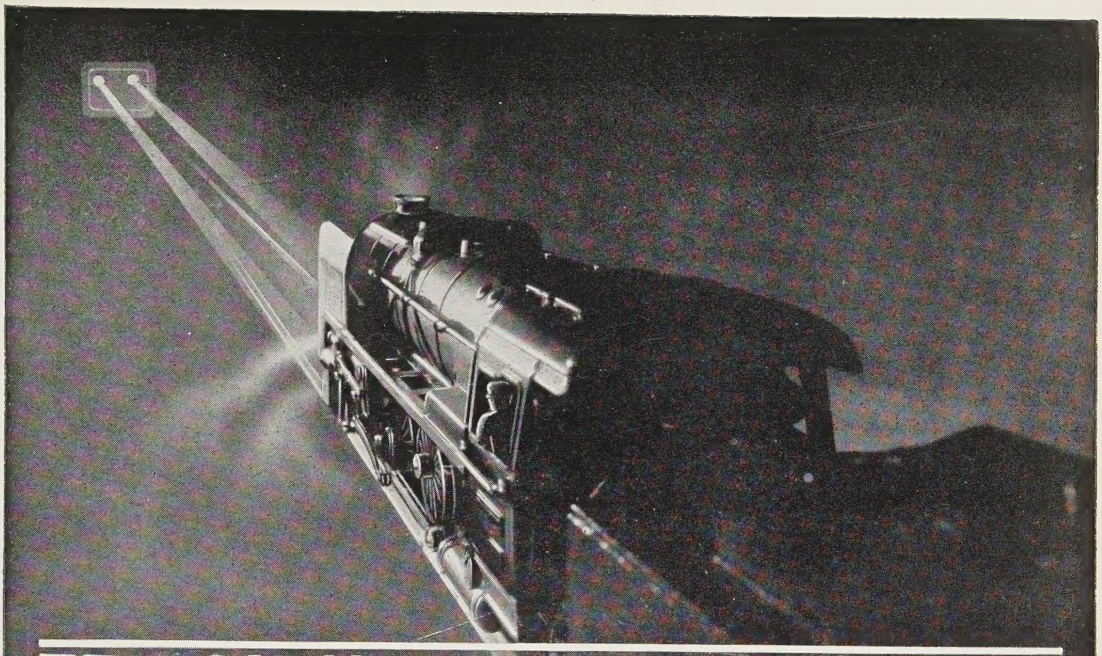

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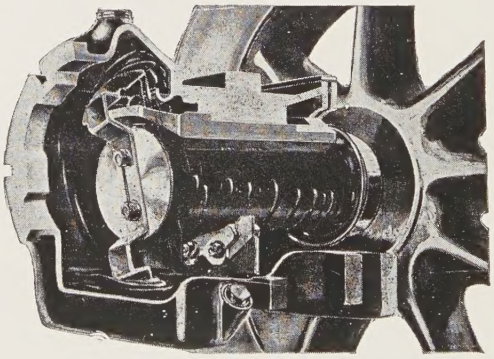

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MONTHLY BULLETIN

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(ENGLISH EDITION)

PUBLISHING and EDITORIAL OFFICES : 19, RUE DU BEAU SITE, BRUSSELS.

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An edition in French is also published.

VOL. XXIII. — No 7. October 1946.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[656 .234]

Tickets,

Continued (*).

by Mr. LIONEL WIENER,
Professor at the University of Brussels.

PART E.

TICKET REPRESENTATION OF TARIFFS. SPECIAL TICKETS.

Supplements.

As there are reduced fares and increased fares in addition to the ordinary fares, a passenger with one sort of ticket must be able to travel at a different rate without having to pay the whole fare over again. For this purpose the Railways issue supplements for the difference in the rates and other tickets which correspond to all the additional charges in excess of those paid for with the original ticket. We will group these as follows :

1. SUPPLEMENTS FOR COMFORT :
a) Change of class;
b) Seat reservations;
c) So called luxury seats;

2. SUPPLEMENTS FOR SPEED;

3. MODIFICATION OF THE JOURNEY :
a) Change of route;
b) Extension of the journey;
c) Special journey;

4. MODIFICATION OF VALIDITY :
Extension of validity;

5. SUPPLEMENTARY FARES;

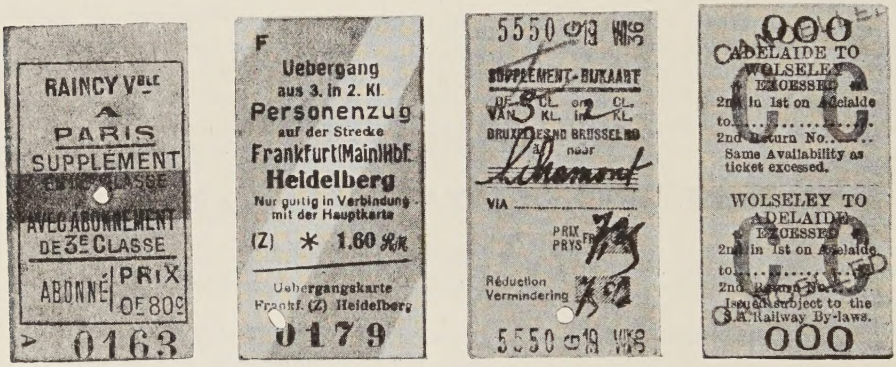
6. VARIOUS.

1. Supplements for comfort. — *a*) CHANGE OF CLASS means a change from 3rd. to 2nd., 2nd. to 1st. or 3rd. to 1st. class. Such supplements are also erroneously called « surclassement » (higher class) tickets.

(*) See *Bulletin of the International Railway Congress Association*, No. of March, May, July, September, and November 1938, p. 217, 473, 665, 893, and 1079; No. of July 1939, p. 673 (beginning of *Part E*) and No. of September 1946, p. 267.

Anvers G. C.
à Bruxelles N.
ou vice-versa
Supplément de 3me Classe en 2me Classe
Antwerpen C.S.
naar Brussel N.
of omgekeerd
Bijkaart van 3e Klasse in 2e Klasse
TRAINS: TREINEN:
230 231 203 261
232 252 253 267
240 260 257 277
242 268 259 279
01149
1L 1.20
Mois : I II III IV V VI VII VIII IX X XI XII
Imp. V. H. Maertens, Bruxelles

Fig. 970. — Paper ticket for the first block trains between Brussels and Antwerp, issued on the train. — List of months, day of month, and train numbers. — *Belgian State Rys.* (1897). (Scale 3/4.)



Supplementary tickets. (Scale 4/5.)

Fig. 971. — 1st. class supplement for holder of 3rd. class ticket. — French *Est Railway.*

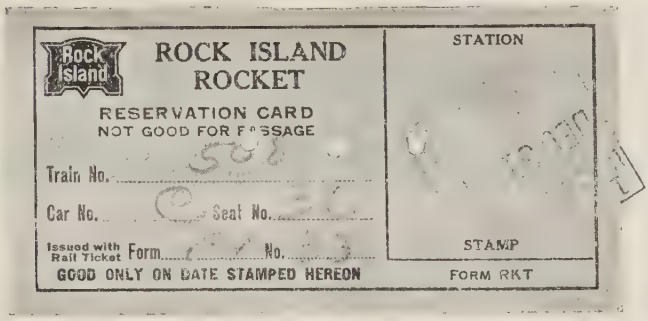
Fig. 972. — Supplement for change of class. — *German State Rys.*

Fig.973. — Blank supplement for all classes, printed at time of issue by an A.E.G. machine. — *Belgian National Railways.*

Fig. 974. — Return supplement. — *Australian Govt. Rys.*

Tickets for seat reservations. (Scale 3/4.)

Fig. 975. — With plan of compartment. — *P.L.M. Railway.*



Tickets for seat reservations. (Scale 3/4.)

Fig. 976. — Reservation card of the *Chicago, Rock Island & Pacific.*

Formely all the Railways had change of class tickets printed in advance in the case of all the most usual journeys. These were generally two coloured, showing the colour for each class concerned; in certain cases the division was parallel to the long side of the ticket (1).

The *Belgian State Railways* had supplements printed in advance for use between certain fixed places in the colours of the two classes divided diagonally (2) (Fig. 996).

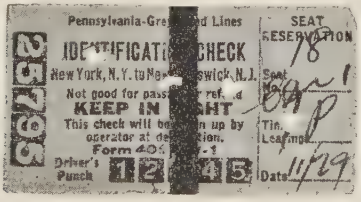


Fig. 977. — Seat reservation ticket (Scale 4/5). — Spaces for perforation. — *Pennsylvania Greyhound Lines.*

With A.E.G. machines, it is possible to use blank tickets for all classes of supplements. These are dated and numbered by the machine, but the additional information is written in by hand (Fig. 973).

Certain Railways have supplementary return tickets (Fig. 974).

Apart from supplements for certain ordinary journeys, at the present time the practice is to use blank slips which can be used for many purposes.

In the first block trains between Brussels and Antwerp, the tickets were issued on the train to save passengers from

Tickets (Scale 4/5).

Fig. 978. — Place in a sports train — special train — *Austrian Federal Rys.*

Fig. 979. — Return ticket, the outward portion entitling holder to a sleeping car berth, the coupon to be exchanged for a return ticket — *Central Argentine Ry.*

In the first block trains between Brussels and Antwerp, the tickets were issued on the train to save passengers from

(1) In Switzerland and France.

(2) On the *Belgian State Rys.* sometimes merely a red diagonal line.

PULLMAN CAR COMPANY LIMITED.
CAR SEAT NO.
From KING'S CROSS (A 421)
Available for one journey only when accompanied by a THIRD CLASS Railway Ticket.
PRICE 7s.0d.
FOR CONDITIONS SEE BACK
L.N.E.R.
THE CORONATION
CAR SEAT NO.
From KING'S CROSS (S.M.)
To NEWCASTLE
Available for one journey only when accompanied by a THIRD CLASS Rail Ho
SUPPLEMENT FARE 3s.0d.
SLEEPING BERTH TICKET
INTER-SYSTEM EXPRESS
CENTRAL
Berth No. 10
Train 8.30
Great Western Railway
PENZANCE & PADDINGTON
SLEEPING CARRIAGE
Entitles holder, on date of issue only to a Third Class Sleeping Berth on production of a Third Class Railway Ticket covering the journey desired to be made in the Sleeping Car
CHARGE 6/0
See back

Supplements for comfort. Edmonson tickets. (Scale 4/5.)

Fig. 980. — Tickets for reserved seats on third class Pullman — *London & North Eastern Ry.*

Fig. 981. — Sleeping car berth on an « Inter-System Express » — Date stamped — *New South Wales Govt. Rys.*

Fig. 982. — Supplement for a seat in the « Coronation » train — *London & North Eastern Ry.*

Fig. 983. — Sleeping car ticket, surcharged with figure showing the class — *Great Western Ry.*

queuing up at the booking office. The supplements were also paper tickets printed in advance, like those used on tramways (Fig. 970).

Many tramway companies with two classes also issue supplements for change of class, these being special tickets used only for this purpose *(Fig. 843)*.

1. *b*) RESERVATION OF SEATS. — The number of seats available on certain trains — express trains, light trains, special trains or excursion trains, railcars — is limited. The seats are numbered so that they can be reserved by buying special tickets, issued for the purpose, on which the number of the seat is indicated. Sometimes a diagram of the carriage is given on the ticket showing the arrangement of all the seats (Fig. 975 [1]).

The cost of reserving a seat is generally independent of the mileage (Figs. 976 to 978) [2]; it is rarely free [3].

1. *c*) SUPPLEMENTS FOR LUXURY SEATS. — The principles according to which tickets are issued for luxury seats — sleeping cars, saloon or Pullman cars — differ according to whether such stock belongs to the Railway Company or not. In certain cases, the reservation of the seat is included in the charge, whilst in others it is not.

---

[1] On the *P.L.M. Ry.*

[2] On the *London and North Eastern Ry.* excursion train from King's Cross to Skegness; the charge for reserving a seat is 6 d.
It is 1 $ 100 on the Rio Grande do Sul railcars in the case of a journey from Porto Alegre to Caxias.

[3] *New South Wales Govt. Rys.* — « The Caves Express ».

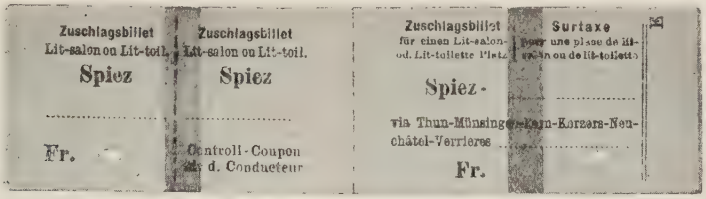


Fig. 984. — Supplement for special sleeping car accommodation. — Issued by the *Thunerseebahn.* — With coupon to check the route. (Scale 4/5.)

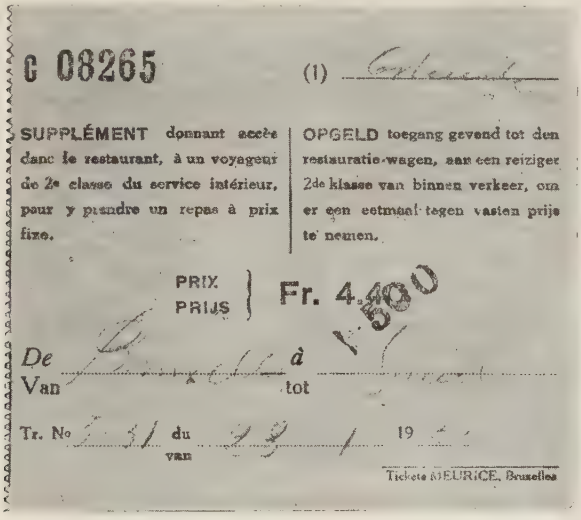

C 08265
(1)
SUPPLÉMENT donnant accès dans le restaurant, à un voyageur de 2e classe du service intérieur, pour y prendre un repas à prix fixe.
OPGELD toegang gevend tot den restauratie-wagen, aan een reiziger 2de klasse van binnen verkeer, om er een eetmaal tegen vasten prijs te nemen.
PRIX
PRIJS
Fr. 4.60
De
Van
à
tot
Tr. No
du
van
19
Tickets MEURICE, Bruxelles

Fig. 985. — Supplementary ticket giving access to restaurant car. — *Belgian State Rys.* (Scale 3/4.)

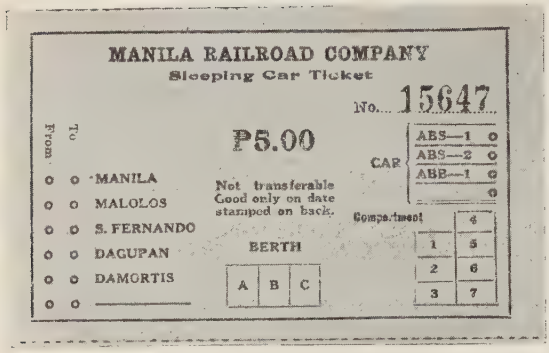
In America, there is a still greater number of such special coaches :

Standard sleeping Car;
Parlour car;
Tourist car.

As there are various kinds of berths in the same sleeping car, the tickets have lists of all available places so that it is only necessary to perforate the one used.

The supplement, which is sometimes a duplex or triplex ticket (Fig. 986) gives all details of the journey, including naturally the list of seats which is given by a series of numbers. Tickets are collected during the journey and a token given in exchange which merely shows the numbers; this token must be worn conspiciously and is itself collected at the end of the journey *(Fig. 285).*

The English Companies have fixed night supplements independent of the



Supplements for luxury travel. (Scale 3/4.)

Fig. 986. — Sleeping car supplement. — Indicating the car, the compartment, and the berth, the start and destination. — *Manila R.R. Co.*, Philippines.

Fig. 987. — Card for seat in a saloon car. — *Dorada Ry.*, Columbia.

distance covered. These amount to 15 sh. 9 d. and 21 sh. 1st. class, according to whether the journey is entirely in England or in England and Scotland, while the 3rd. class supplements amount to 6 sh. 6 d. and 7 sh. 6 d. respectively (Fig. 983). This practice is not followed in France, but in both cases the ticket is merely an additional charge for extra comfort.

The Railways also issue supplements for some of their important trains made up of special stock (1), as well as for stock belonging to other Companies running on their lines (Fig. 984).

Such supplements are generally blank Edmonson tickets (Figs. *647*-981) or available between specified places (Fig. 982). Paper tickets are only used in a few cases, while cards are even rarer (Fig. 987). In the Argentine return tickets are issued which entitle the holder to a sleeping berth; the return half is exchanged at the booking office for an ordinary single ticket (Fig. 979).

Supplements for the use of a cabin in the case of sea crossings also come under the category of comfort supplements.

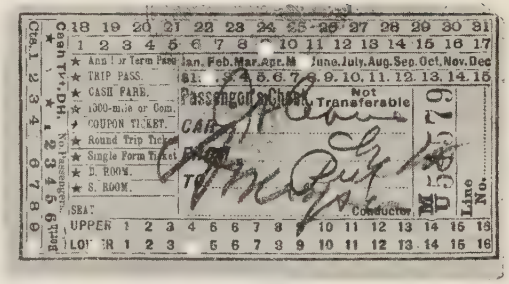
Access to restaurant cars is usually free for all classes of passengers, or only for certain classes. For a time, however, in Belgium tickets were issued for a fixed sum of 5 fr. which entitled the holders of second class tickets to have access to a restaurant car for a meal (Fig. 985). The same practice was followed in Ireland. Here again, this comes under the category of a supplement for comfort.

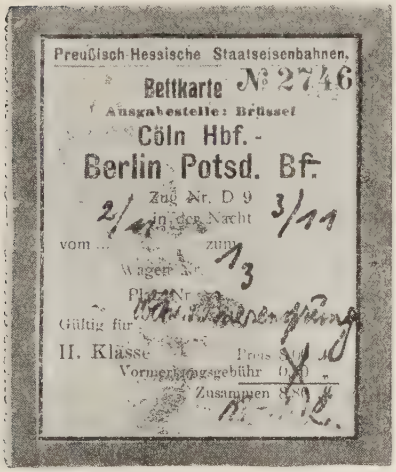
It is a different matter when the luxury stock belongs to a separate Company, such as the *International Sleeping Car Company*, the *Mitropa*, or the American and English *Pullman Companies*.

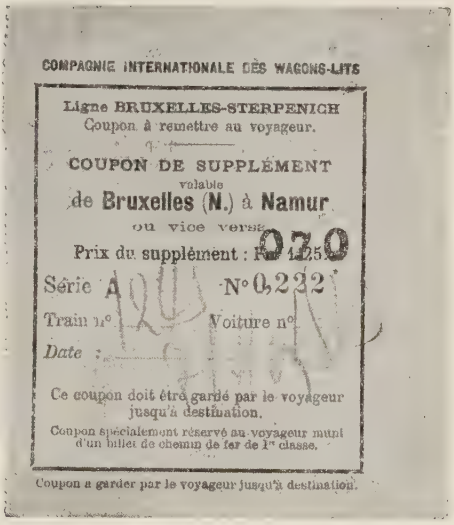
(1) Here are some examples taken from English trains :

	1st. class	*3rd. class*
« The Coronation » London to Edinburgh	6 sh.	4 sh.
« The West Riding Ltd. » London to Bradford or Leeds	4 sh.	2 sh. 6 d.
« The Silver Jubilee » London to Newcastle	5 sh.	3 sh.
« The Silver Jubilee » London to York	4 sh.	2 sh. 6 d.
« The Silver Jubilee » York to Newcastle	3 sh.	2 sh.

F. C. MEXICANO.
CARRO DORMITORIO.
México (Agencia) a Veracruz
TALON DEL CONTADOR
El Portero remitirá este talón á la Contaduría.
México (Agencia) a Veracruz






COMPAGNIE INTERNATIONALE DES WAGONS-LITS
Ligne BRUXELLES-STERPENICH
Coupon à remettre au voyageur.
COUPON DE SUPPLÉMENT
valable
de Bruxelles (N.) à Namur
ou vice versâ
Prix du supplément : F 12,50
Série A
N° 0,232
Train n°
Voiture n°
Date :
Ce coupon doit être gardé par le voyageur jusqu'à destination.
Coupon spécialement réservé au voyageur muni d'un billet de chemin de fer de 1re classe.
Coupon a garder par le voyageur jusqu'à destination.

Sleeping car tickets. (Scale 3/4.)

Fig. 988. — Sleeping car supplement of the Pullman type with check stub. — *Mexican Ry. Co.*

Fig. 989. — Sleeping car supplement on the *Prusso-Hessian State Rys.* — Card framed in the colour of the class.

Supplement tickets. (Scale 3/4.)

Fig. 990. — Card for sleeping cars of the *Pullman Palace Car Co.* — All data indicated by perforation.

Fig. 991. — Supplement for saloon car of the *Belgian State Rys.*, run by the *International Sleeping Car Co.*

The *International Sleeping Car Company* charges a mixed supplement for the use of its sleeping cars, Pullman cars and saloon cars, this in fact including a supplement for comfort and a supplement for distance. It includes more than this, as Government taxes and royalties due to the Companies owning the lines are also covered.

Paper tickets are used exclusively, being issued for journeys between stated places for the most frequented day journeys, which means that a considerable amount of tickets are required. Tickets taken in advance are issued in triplicate, one part being kept by the passenger and the other by the ticket collector, the third being the counterfoil.

When a passenger buys his ticket during the journey, in the case of the most usual runs, he is issued with a ticket printed in advance, known as a « No. 2 coupon », and in the other cases with a general purpose ticket (Figs. 991-992).

With one exception, in the case of passengers for the South of Germany, the supplements charged by the *Mitropa* are exclusively comfort supplements. Consequently, whatever the length of the journey, there are only two charges per class in the case of internal traffic (1) :

1st. class	29.— and 25.— RM.
2nd. class	14.50 and 12.50 RM.
3rd. class	8.— RM.

The English *Pullman Company* charges a supplement for comfort only, which varies however according to the class and the line (2). When it issues these tickets itself, paper tickets between fixed places are used or blank tickets; when the Railway Companies issue Pullman tickets, Edmonson tickets are always used (Fig. 980).

The American *Pullman Company* does likewise, though the amount of the supplement charged varies with the distance. It owns an impressive series of coaches, and though for all the different services the same supplements are used, there are a great number of different charges which depend especially upon the type of coach and event the type of compartment to which it gives access.

The original company, the *Pullman Palace Car Co.* used to make use of universal card type tickets (Fig. 990), similar to the old tickets of the present Company *(Fig. 601)*. Since then, smaller tickets have been adopted (Figs.*8*-988).

Finally it should be noted that certain Railways Companies sell tickets which include both the ordinary fare and the supplement for use of the luxury car. This is the case of the « Billet de passage comptant de char salon » (Ticket for the journey including use of the saloon car) (the text is in French on the Canadian ticket) which we have shown in *Fig. 253*.

ROAD FIRMS', TRAMWAYS', ETC., SUPPLEMENTS. — The road firms have to issue supplements for change of class, extension of the journey or other cases. In such cases they usually make use of a single kind of ticket which can be used for all these purposes. A list is given on the ticket, and that applying can be shown. In addition, as the ticket depends on the value at which it is sold, if this corresponds to any particular journey (often a journey at a reduced fare) it can also be used for this purpose.

When coupons are used, their value is calculated so that one of them can, if need be, be used as a supplement. Several can be used for supplements of a higher value.

2. Supplements for speed were in force, formerly, on most Railways, but most of these have been suppressed; the *Great Northern Ry.* of Ireland only gave up in 1916, charging a supplement of one shilling for third class passengers who wished to travel in the *mail* trains.

Such additional charges were justified

---

(1) International traffic :

With Switzerland . .	38.— and 19.— RM.
With Holland . . .	27.— and 15.50 RM.
With Denmark and Sweden	27.— and 13.50 RM.

(2) Boat trains :

from London to Dover, Folkestone or Southampton	3 sh. 6 d.
from London to Brighton or Portsmouth	1 sh.

Fig. 992. — Triplex coupon for supplement charged for saloon car on the old « Amsterdam-Switzerland Express » of the *International Sleeping Car Co.* — Back printed in German.

however just as much as those for comfort, as speed involves the Railways in considerable additional expenses.

Supplements for speed differ according to whether the fares are differential or by zones.

a) **Differential rates.** — In such cases supplements for speed were usually Edmonson tickets printed in advance for the most usual journeys (Fig. 1003). There were also two coloured supplements for transfering from a lower class in an ordinary train to a higher class in an express train (Fig. 996).

In America, strip tickets were used with a list of values, that authorising the passenger to travel in one of extra fare trains being perforated. If the train was late, it was considered that charging the extra fare was no longer justified, and the Company had to refund it in proportion to the delay. The number of hours delay was therefore shown and a special refund check issued which enabled the holder to obtain the necessary repayment *(Fig. 71)*.

b) **Zoning rates.** — Following the example of Germany, the supplement for speed was often based on zones. It differed according to whether through trains (Eilzüge), express trains (D-züge) or very important express trains (FD-Züge) were involved, the amount of the supplement for different zones on the trains being the same as

Edmonson supplement tickets. (Scale 4/5.)

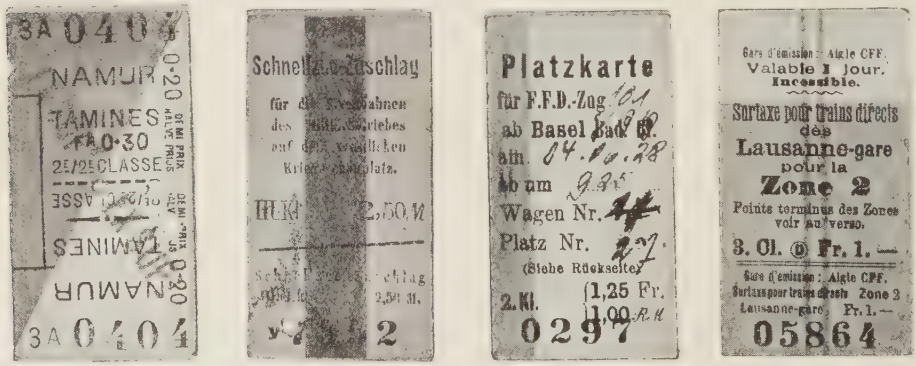
Fig. 993. — Railcar supplement. — French *Nord Rys.*

Fig. 994. — Supplement issued by the *Belgian States Rys.* for the « Ostend-Cologne Express ».

Fig. 995. — Fixed price supplement in two languages issued by the *Belgian State Rys.* for use on international or luxury trains.

those of the next lower zone on the *E.* trains. These supplements were issued in various forms : coupons for booklets of coupons (Fig. 1002), cardboards cards (Fig. 1000), or Edmonson tickets (Fig. 998 for an *FFD* train, *200* for *FD* trains and 997 for military trains).

In Switzerland there are « surcharge tickets for through trains ». These are zonal tickets on the backs of which are



Supplements for speed. (Scale 4/5.)

Fig. 996. — Ordinary 2nd. class to 2nd. class express — Colours of both rates. — *Belgian State Rys.* (1894).

Fig. 997. — Supplement for express train — *Military Ry. of the Eastern front.*

Fig. 998. — Place in an « FFD » train *German State Rys.* — Value in Swiss francs and German RM.

Fig. 999. — Zonal surcharge for through trains (express supplement). — List of destination stations on back. — *Swiss Federal Rys.*

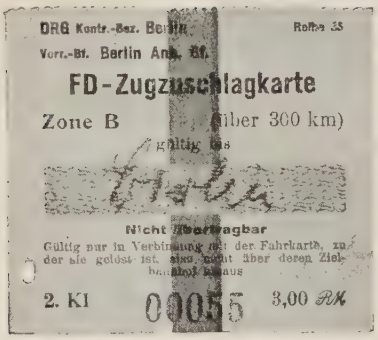


Fig. 1000. — Zonal supplement card for « FD » train (Scale 3/4). — *German State Rys.* — Band in colour of the class.

printed a list of all the stations in the zone (Fig. 999).

In Holland the supplement is a paper ticket sold at a uniform price of one

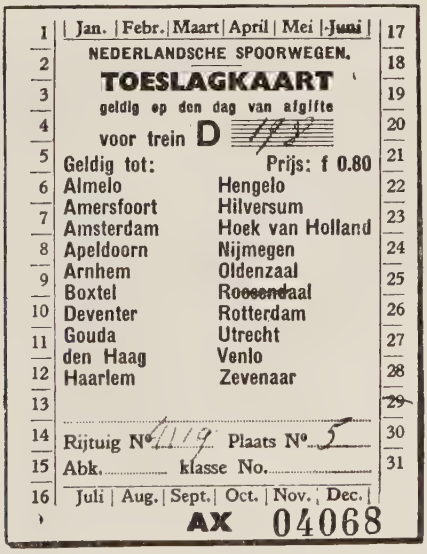


Fig. 1001. — Fixed price express supplement according to class with list of destination stations, months and days of the month. — *Netherlands Rys.* (Scale 3/4.)

florin for first class and 80 cents for second class, whatever the distance, available on all the *L* or *D* trains (Fig. 1001). When necessary the supplement for comfort charged by the *Wagon-Lit Company* or *Mitropa* has to be added to this. Tickets for the international and luxury trains which were sold for a time by the *Belgian State Rys.* at a standard rate of 2 fr. came in the same category (Fig. 995). In addition, this same Administration issued supplements at a fixed rate of 20 fr. for first class for the «Ostend-Cologne Express » (Fig. 994).

3. Changes of journey involve the issue of three kinds of tickets :

a) Tickets for a change of route;
b) Extension of the journey;
c) Special route.

3. — *a*) Tickets for a change of journey. — There are tickets printed in advance for certain frequent changes of journey.

When the same fares are charged over each route, provided the two possible routes are shown on the ticket, there is no need to issue special ticket in advance. It is sufficient to make sure of an adequate check on the journey by providing a detachable coupon on the ticket which can be removed on the journey actually taken. But if there is a difference in the fares, this has to be represented by an additional ticket (Fig. 1004).

The return half of a return ticket can be made available over a different route on payment of a certain supplement (1).

There are tickets for a change of route printed in advance for the full and reduced fares, corresponding to the different methods of transport used.

(1) *Geneva Navigation Company.* — « Ticket for return journey by boat or supplement for return journey by rail on payment of ... fr. ».

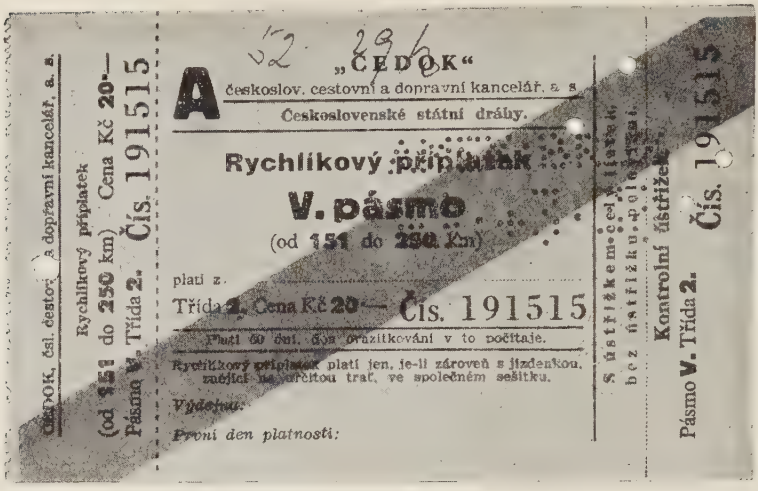

„ČEDOK"
československ. cestovní a dopravní kancelář, a. s.
Československé státní dráhy.
Rychlíkový příplatek
V. pásmo
(od 151 do 250 km)
platí z
Třída 2. Cena Kč 20— Čís. 191515
Platí 60 dní, den vyražitkování v to počítaje.
Rychlíkový příplatek platí jen, je-li zároveň s jízdenkou, znějící na určitou trať, ve společném sešitku.
Výdejna:
První den platnosti:
Rychlíkový příplatek (od 151 do 250 km) Cena Kč 20— Třída 2. Čís. 191515
Pásmo V.
Kontrolní ústřižek
Pásmo V. Třída 2. Čís. 191515

Fig. 1002. — Zonal supplement for express train with coloured band according to the class. — *Cedok Agency* stub. — With check stubs. — *Czechoslovakian State Rys.* (Scale 3/4.)

Fig. 1003. — Supplement ticket for transfer from an ordinary train to an express train. — *London Brighton & South Coast Ry.*

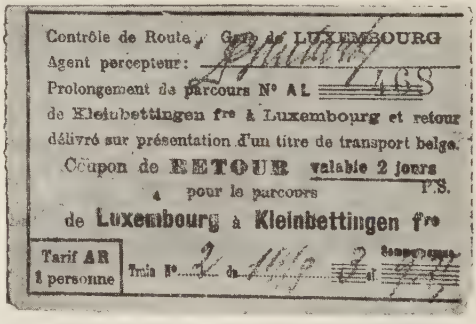
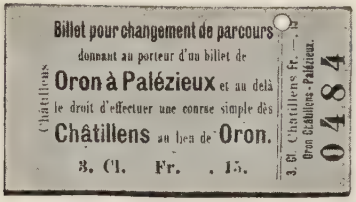

Contrôle de Route
Agent percepteur:
Prolongement de parcours N° A L
de Kleinbettingen frc à Luxembourg et retour
délivré sur présentation d'un titre de transport belge.
Coupon de RETOUR valable 2 jours
pour le parcours
de Luxembourg à Kleinbettingen frc
Tarif AR
1 personne
Train N°

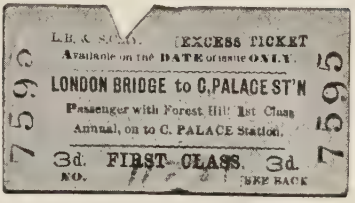
Fig. 1004. — Return supplement for extension of journey. (Scale 3/4.) — *Alsace-Lorraine Rys.*, journey over the lines of the *Guillaume-Luxemburg Ry.*

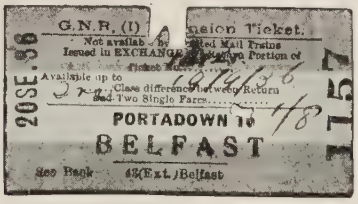
3. — *b*) EXTENSION OF THE JOURNEY. — A regularisation chit or a ticket in the case of a frequent extension, is used from the point at which the original journey ended (1).

These are also issued to the holders of ordinary season tickets or workmen's tickets (Figs. 1005-1008-1009) (2). The ticket for the extended journey can be issued to complete the one already held by

(1) *Thunerseebahn.* Extension in ... class to Scherzlingen.
Pennsylvania Ry. — From or to New York in connection with a ticket reading to or from Hudson Terminal or Ferry Station.
(2) *Belfast & County Down Ry.* — Subscribers extension from Holywood Marino or Craigavad. — Return ticket.
General Swiss season tickets. — Additional fare for the frontier section from Pontarlier to Vallorbe.
Supplementary ticket for general season ticket (Rabattbillet) from Arth-Goldau to Righi-Kulm or vice versa.


Billet pour changement de parcours
donnant au porteur d'un billet de
Oron à Palézieux et au delà
le droit d'effectuer une course simple dès
Châtillens au lieu de Oron.
3. Cl. Fr. . 15.
Châtillens
0484


L.B. & S.C.Ry. EXCESS TICKET
Available on the DATE of issue ONLY.
LONDON BRIDGE to C.PALACE ST'N
Passenger with Forest Hill 1st Class
Annual, on to C. PALACE Station.
3d. FIRST CLASS. 3d.
NO.
SEE BACK
7596



Edmonson supplement tickets. (Scale 4/5.)

Fig. 1005. — Ticket for change of route.

Fig. 1006. — Ticket for extending the journey issued to a yearly season ticket holder. — *L. B. & S. C. Ry.*

Fig. 1007. — Ticket for extending the journey, the price of which is the difference between a return ticket and two single tickets. — *Great Northern Ry.* of Ireland.

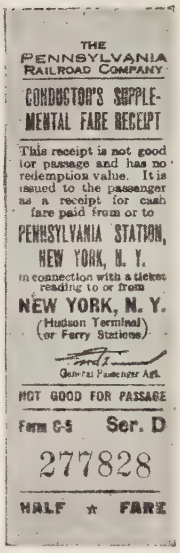
the passenger or to take its place (Figs. 1006-1008); paper tickets are not often used (Fig. 1010).

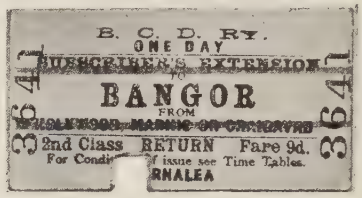
There are also cases where the extension is purely mythical. To prevent overcrowding on some of its important trains, the French *Est Railway* only allows those travelling a minimum distance of 100, 200 or 300 km. (62, 124 of 186 miles) to travel on such trains. Other passengers can travel in them provided they pay for the specified mileage, even though they do not wish to travel so far, and special tickets of all categories (single, return, half and quarter price) are issued for this purpose (Figs. 1012 and 1012 *bis*).

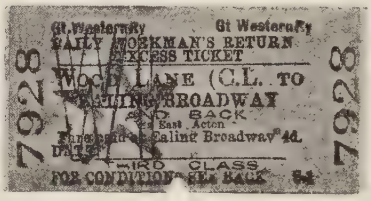
To reduce the number of different sorts of tickets, certain Railways have done away with fixed tickets to stations for which there is the least demand, and only issue tickets for the more important stations situated beyond the former and known as « gares de rattachement » (connecting stations). On the French *Est Ry.* special plates are used in the A.E.G. machines for various distances between such connecting stations and stations for which there are no plates. The additional number of miles to be added is shown on the back of the ticket and the name of the destination station is inserted by hand together with the amount of the fare (1).

3. — *c*) A somewhat different category is that affecting certain sections of line where special conditions apply, particularly on tramway systems or light railways (Fig. 1013).

(1) See *Bulletin* for November 1938, page 1131.





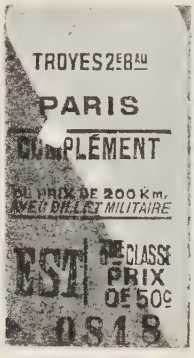


Supplements. (Scale 4/5.)

Fig. 1008. — Supplement for journey in Manhattan issued on the train. — To be perforated for half fare. — *Pennsylvania RR. Co.*

Fig. 1009. — Extension of journey issued to season ticket holder. — *Belfast & County Down Ry.*

Fig. 1010. — Supplement for return journey issued to workman season holder. — Surcharged with initial letter of category, and distinctive mark. — *Great Western Ry.*



Edmonson supplement tickets. (Scale 4/5.)

Fig. 1011. — Ticket for extending a journey issued to race course staff. — French *West, Ceinture and North Rys.*

Fig. 1012. — Virtual supplement for mileage of 200 km. (1896). — Category : military. — French *Est Ry.*

Fig. 1012 *bis.* — Return ticket for virtual mileage extended to 100 km. (62 miles). — French *Est Ry.* (Scale 4/5.)

4. — Modification of period of validity. — EXTENSION OF VALIDITY. — In certain countries it is possible to have return tickets extended on payment of an additional amount. Special tickets are rarely issued for this purpose. We will mention in passing stopping tickets

Fig. 1013. — Supplement for weighbridge section belonging to another company (town of Brussels). — Exhibition of 1935. — Monogramme of the *Brussels Tramways Company*. (Scale 3/4.)

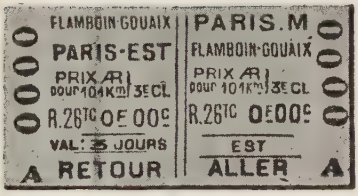
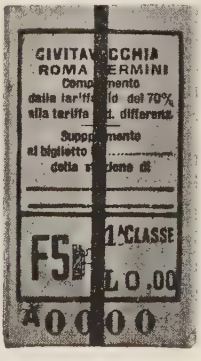


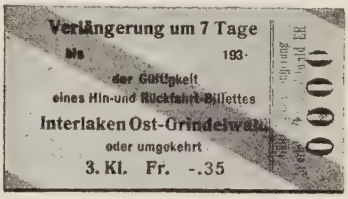
Fig. 1014. — Return ticket for journey increased empirically to 101 km. (63 miles). — Vertical line indicating the return half. — French *Est Ry.* (Scale 4/5.)



Supplement tickets. (Scale 4/5.)

Fig. 1015. — Temporary surcharge for return coupon issued with season ticket. — French *Est Ry.*

Fig. 1016. — Supplement for changing from 70 % reduced rate to differential rates. — Fascist emblem. — *Italian State Rys.*



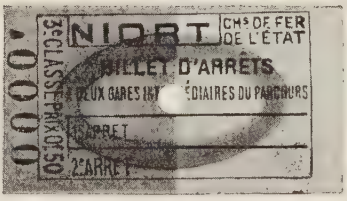


Fig. 1017. — Ticket for extending validity. — *Bernese Oberland Ry.* (Scale 4/5.)

Fig. 1018. — Stopping ticket for two intermediate stations. — *French State Rys.* (Scale 4/5.)

which also affect the time of the journey. (Figs. *488-489-*1016).

In France the time of validity was the greater as the journey was longer. Holders of tickets valid for a shorter period could enjoy the same validity as those allowed for longer journeys by buying special tickets to complete the actual length of their journey. But whereas the tickets for an extension of the mile-

Edmonson supplement tickets. (Scale 4/5.)

Fig. 1019. — Supplement from local to main. — Block letters. — *London Brighton & South Coast Ry.*

Fig. 1020. — Supplement for all purposes issued by the captain. — *Navigation Company of the Thun and Brienz Lakes.*

Fig. 1021. — Supplement ticket. — *Hungarian State Rys.*

Fig. 1022. — Supplement for all purposes. — Issuing station. — *Belfast & County Down Ry.*

age about which we have already spoken were for mileages of 100, 200, 300 km. (Fig. 1012), these latter completed the mileage up to 101, 201, 301 km. (63, 125 and 187 miles) (Fig. 1014), the starting point of journeys for which the period of validity was considerably longer.

5. — Supplementary rates. — Such tickets are issued to passengers who wish to change from a reduced rate to a higher rate, for example from a zonal rate to a differential rate (Fig. 1018) or from workingman's rate to an ordinary rate.

In other cases, a suburban section of line may be run over by both local trains and main line trains. To prevent overcrowding on the latter, a higher fare is charged on such trains between the same places. There are then supplements for transfering from the local trains to the main line trains (Fig. 1019).

For the same reason higher fares are in force on the boat trains on the *Southern Ry.* than on the other express trains which are just as comfortable and often faster.

TRAMVIE del
COMUNE di MILANO
Il passeggero che al controllo non è in grado di presentare il biglietto o presenta un biglietto irriconoscibile o comunque non valido, è obbligato a munirsi *oltre che del biglietto ordinario anche di biglietto speciale da L.* 2.- *rilasciato dal Controllore.*
(Art. 3 e 10 del Regolamento)
46 00023

Fig. 1023. — Ticket for a 2 lire fine. — *Milan Tramways.* (Scale 3/4.)

The additional fares charged in America for the use of certain « transfers » also comes into this category. There is a single fare connecting with the tram-

way or omnibus services. The fares on the omnibus or trolleybus are however often higher than those on the tramways. To equalise the value of the « transfers » when a line where the higher fare is in force is used, an additional amount must be charged. This additional 2 or 3 cents is either paid in the vehicle in which the holder has received the « transfer » or on the connecting vehicle.

Another class of higher fares must be mentioned here. This is when use is made of a virtual mileage which increases the real distance by a certain number of fictitious miles in order to increase the receipt and defray exceptional expenditure involved at a given point, this being a special temporary surcharge specially authorised. Started in Hungary, this system was also formerly used in Belgium and is made use of above all in France (Fig. 1017).

Certain tramway Companies issue special tickets which in addition to the ordinary fare include a fine to be paid by passengers found travelling without a ticket (Fig. 1023).

6. — Various supplements. — General. — There are also supplements for all purposes, which are merely printed with the amount charged. These are found on railways, tramways and navigation companies (Figs. 1020-1022).

(To be continued.)

[621. 133. 1 (.42)]

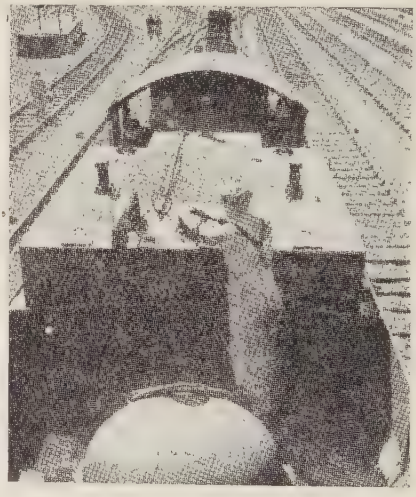
Oil fuel for steam locomotives.

Extension of G.W.R. experiments.

(Modern Transport.)

This week the Great Western Railway has turned into traffic a locomotive of the Hall class — a mixed-traffic 4-6-0 type — converted to burn oil fuel. Schedded at Swindon, it will be operating on Swindon-Bristol, Bristol-London and London-Swindon duties, and will thus afford opportunity for the gathering of further data on oil firing of locomotives, this time in passenger service. It will be recalled that with commendable foresight the chief mechanical engineer of the G. W. R., envisaging over a year ago the present serious coal situation, made arrangements to secure data on oil firing by the conversion of two locomotives; it was then thought by the management that a larger scale experiment would be desirable to establish the extent to which economies could be effected by the use of oil instead of coal, particularly in respect of the time required for servicing and preparation of engines, and work proceeded in conjunction with the Anglo-Iranian Oil Co., Limited. As a result, from November last year the conversion of ten 2-8-0 2800 class tender locomotives and eight 4200 class 2-8-0 tank engines has been proceeding, and these engines are engaged in main line freight traffic in South Wales from Severn Tunnel Junction and Llanelly sheds. At these points fuelling plant has been established for the purpose.

Of these 18 engines ten are already in service, hauling trains of up to 1 000 tons. Experience has shown that the performance of an oil-fuelled locomotive equals that of a similar coal-burning locomotive in good running condition, and that a heavy freight locomotive, under load, consumes six gallons of heavy fuel oil per mile as compared with 75 lb. of coal. The use of oil enables savings to be effected in servicing while the engines are in the running sheds and a reduction in manpower due to the elimination of coal loading and removal of ashes. The work of the fireman is also considerably reduced.



View from rear of tender of G. W. R. oil fuel locomotive No. 5955 *Garth Hall.*

For passenger work.

As a result of the experiments and in view of the continued shortage of coal on the one hand and assured supplies of heavy oil on the other, it was decided to extend the experiment to passenger services, and Engine No. 5955 *Garth*

Hall, which is of a general utility class, has, as stated above, now been converted and brought into service in working express passenger trains between Paddington and Bristol. The company now proposes still further to widen the experiment by the conversion of 25 4-6-0 express passenger locomotives of the well-known Castle class to oil burning. These engines will be used on main line services between Paddington, Bristol, the West of England and South Wales.

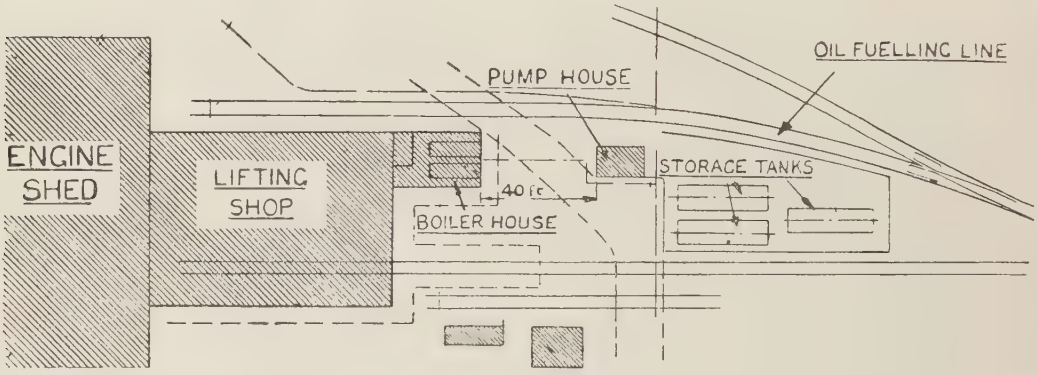
Arrangement of fittings in the cab, conveniently placed to fireman on the left-hand side.

Each engine will carry a supply of heavy fuel oil in the tender sufficient for runs of up to 250 miles, and 24 000 gall. storage tanks for refuelling will be provided at Old Oak Common, Swindon, Bristol (Bath Road), Newton Abbot, Plymouth (Laira), Cardiff and Landore. It is estimated that with the conversion of the 44 passenger and freight locomotives some 50 000 tons of coal will be saved annually and made available for industrial needs.

The oil-burning equipment for the converted engines consists essentially of a weir type burner, an oil-regulating cock and heater, and a steam manifold carrying the necessary control valves. On the tender locomotives oil fuel is contained in a tank having a total capacity of 1 800 gall. and designed to fit snugly into the coal space of the standard G. W. R. 3 500-gall. well-bottom tender. The tank engines are necessarily limited to a tank of about 850-gall. capacity. The oil is fed to the burner by gravity and the atomisation is performed by a steam jet incorporated in the burner. Steam heating coils are provided in the storage tank to ensure that, irrespective of external atmospheric conditions, the oil flows readily and reaches the burner at the temperature best suited to correct combustion. The front of the tank is lagged with asbestos non-conducting composition, and free circulation of air around the sides and back is prevented. A 4-in. oil-filler pipe runs from the top of the oil tank towards the rear, and then passes vertically downward through the water space to the underside of the water tank, where it branches transversely to filling

points on each side. Oil level is indicated by a conventional float.

The lower front portion of the tank is a partially sealed chamber about 3 ft. 6 in. by 2 ft. 4 in. by 1 ft. 8 in., into which the oil flows through holes in the back partition plate, and from which it is drawn through a standpipe 1 ft. 5 in. high. This chamber contains two steam heating coils with a total heating surface of 29 1/2 sq. ft. Auxiliary heating loops, each with a heating surface of 8 1/2 sq. ft., are fitted one on each side of the main tank. In the chamber there is also the bulb of a Rototherm thermometer, the dial of which is carried on the front of the tank. It is the fireman's duty to keep a check on the temperature and to maintain it at the correct level by regulating the passage of steam into the heating coils. The steam supply to the heating coils is controlled by three valves mounted at the front of the tank on a manifold which is fed through a flexible hose from the steam manifold on the engine.



Layout of oil fuel installation adjacent to a locomotive depot.

Burner connections.

Oil from the standpipe passes through a 2-in. shut-off cock and an Auto Klean filter, and thence through flexible hose to a 1 1/2-in. pipe running under the left-hand footplate of the engine. Here it passes through an auxiliary heater in the form of a steam jacket about 5 ft. 3 in. long, and then immediately through the oil-regulating cock to the burner. The oil-regulating cock is linked to a quadrant graduated in degrees and operated through a pinion drive by means of a horizontal control wheel located in the front left-hand corner of the cab.

The steam manifold on the engine, situated immediately to the right of the oil-control wheel, is fed with saturated steam from the boiler fountain and carries five valves controlling steam to (i) the burner, (ii) the burner cleaner, (iii) the normal blower in the smokebox, (iv) the oil-heater on the engine, and (v) the oil-heaters on the tender. A sixth valve on the manifold enables steam from an outside source to be made available at all these points during lighting up, the supply being taken from another engine or from the boiler washing steam lines in the engine sheds. The connection for this outside steam is provided outside the cab at the front end at the level of the footplating. Each converted locomotive is provided with a special rod to carry burning waste to the burners for lighting up purposes. The steam supply from the manifold to the blower is tapped into the body of the normal blower valve. By this arrangement

steam from the auxiliary supply can be fed to the blower while raising steam and, in addition, the location of the special blower valve close to the other oil-burning controls enables the fireman to operate the blower as required. The spark plates are omitted from the smokebox and after experiment the blast has been sharpened by using a slightly reduced tip diameter.

The floor of the firebox consists of a steel plate in which are cut six rectangular holes giving a total air inlet of 2 1/4 sq. ft. The normal type of ashpan has been modified to provide a firepan, the original damper gear being retained. The air supply to the firebox through the orifices in the floor is controlled by opening or closing the damper doors in the firepan. Stourbridge firebricks,

Standard G. W. R. light tender, converted for oil fuel firing.

Firebox.

The burner, mounted at foundation ring level in a small chamber at the front of the firebox, is of the type in which oil flows over a weir on to a ribbon of steam, by which it is caught up, atomised and projected toward the back of the firebox at a suitable inclination to the horizontal. The oil orifice originally chosen was 2 in. wide by 1/2 in. deep, with a steam orifice immediately underneath 2 1/2 in. wide by 0.030 in. deep. The chamber carrying the burner has a small bottom damper door which can be pre-set to a suitable opening.

having a high alumina content, are used to line the floor and the lower part of the firebox, while a full-length brick arch is fitted. The lining of the firebox retains the heat for a considerable period after the burners are shut off, so that lighting up after a short interval is facilitated. The firehole door has been redesigned to form a reasonably effective seal, and while easily opened is effectively locked when in the shut position. A peep-hole with cover is also provided. Extincteur equipment is provided on the locomotives for dealing with oil fires.

Savings.

Some two months of trial running have taken place with *Garth Hall* since its completion to make experiments which would secure optimum conditions. So far the converted locomotives have suffered no boiler troubles which can be attributed to the use of fuel oil. The Hall class averages an annual mileage of 43 000, and a saving of roughly 1 200 tons of coal per engine is thus anticipated each year. In addition, the availability should be greater in view of the reduction of time in servicing engines when in shed. It was estimated that the eighteen freight engines would save about 13 000 tons of coal annually.

On the other side of the account is the need to provide additional equipment on the ground at each running shed which is to refuel the engines. The oil storage tanks at running sheds are in 12 000-gall. units. As noted already, the sheds which are making provision for passenger service will have 24 000-gall. tanks in the first instance, but the two sheds already fitted (Severn Tunnel Junction and Llanelly) have 36 000-gall. capacity. The tanks are replenished from travelling tanks, each of 3 000-gall. capacity. The oil from the travelling tanks, four of which are dealt with at a time, is transferred through flexible hosepipes to the storage tanks by a steam-driven horizontal duplex pump, 8 in. by 6 1/2 in. by 10 in. stroke, at an estimated rate of 10 000 gall. p.h. To render possible this rate of flow, the viscosity of the oil is reduced by steam heating in both the travelling tanks and the oil pipe line. For refuelling the locomotives, the same pump and pipelines is used, but with the connections to the pump reversed. For this purpose the storage tanks are steam heated and the temperature is maintained at the required level by thermostatic control apparatus.

[656. 212. 9 (.42) & 725. 32 (.42)]

Modern methods of handling goods at railway stations,(*)

by T. W. ROYLE, C.V.O., M.B.E.,
Vice-President of The Institute of Transport.
(*The Journal of The Institute of Transport.*)

It would be well, I think, at the outset to recall that by the end of the 19th century it had become the established railway practice in dealing with the sorting of small consignments in covered goods sheds to provide decks similar to passenger station platforms, over which the goods were sorted and conveyed between rail and road vehicles by means of two-wheeled hand barrows.

Following upon the grouping of the railways the L.M.S. made a survey of the goods sheds which revealed great variations in their design and operation, as developed by the various constituent companies. This applied even in those sheds dealing with similar volumes of traffic.

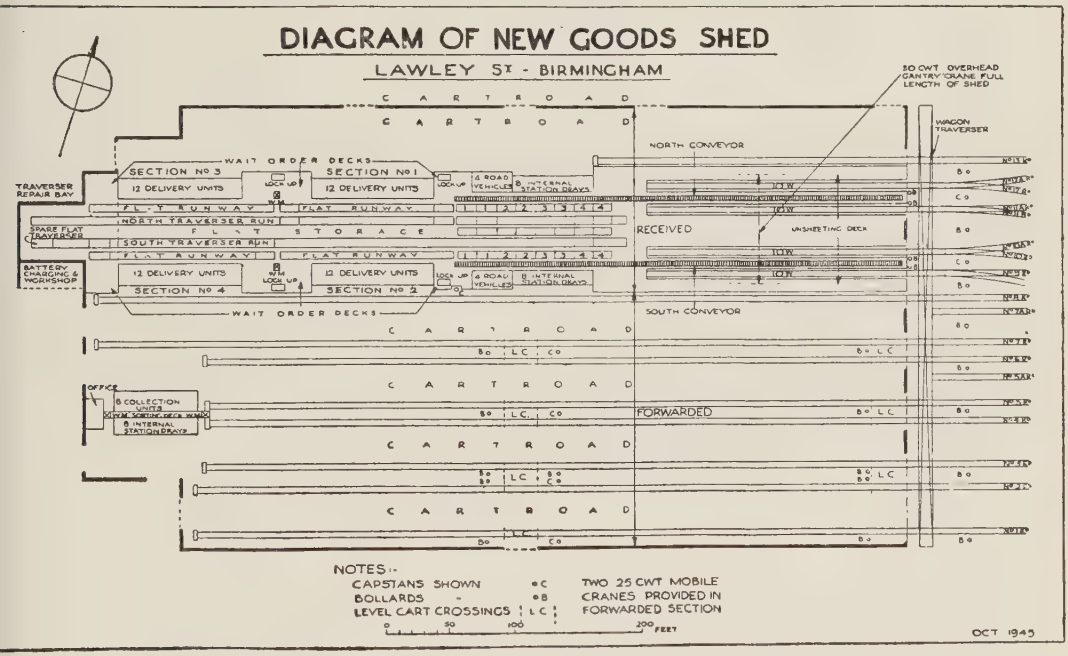


Figure 1.

A striking feature which showed itself was that the larger goods shed the more expensive was the handling of goods.

As a result of the survey, the L.M.S. Railway Company decided, in 1935, to appoint a special staff of expert goods

(*) Paper read in London on November 12th. 1945, at the Institute of Transport.

operators to make a thorough enquiry with a view to ascertaining the best methods and type of lay-out required for handling miscellaneous traffic.

Investigation showed that the better results achieved at the smaller stations were due to the more compact arrangement of the work and to the sorting being simpler. Consideration was therefore given to the problem of securing the advantages of the smaller stations in the lay-out and method of work at the larger depots and, for this purpose, fundamental changes in previous railway practice were not excluded.

The basis of the research into the problem of handling miscellaneous traffic undertaken by the L.M.S. was time-study analysis which, broadly speaking, meant breaking operations down to their component parts and studying how each could best be performed. From the new ideas which emerged practical experience was gained by following particular methods of working with lay-outs specifically designed for such methods, a commencement being made with the smaller stations.

The major features which this enquiry into goods shed working established were :

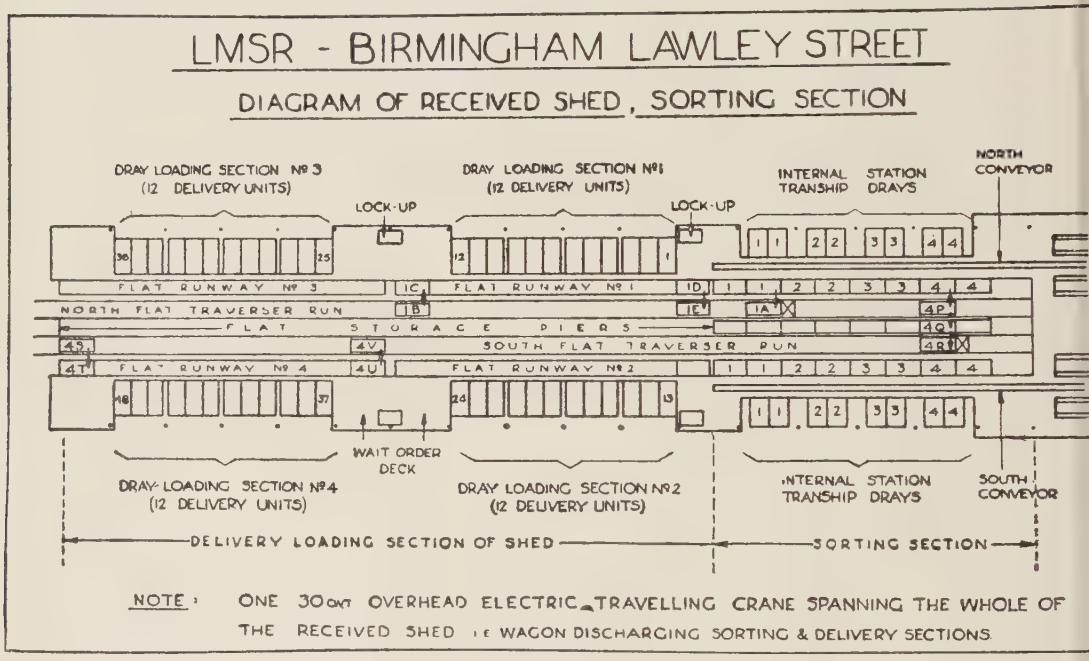

LMSR - BIRMINGHAM LAWLEY STREET
DIAGRAM OF RECEIVED SHED, SORTING SECTION
DRAY LOADING SECTION Nº 3 (12 DELIVERY UNITS)
DRAY LOADING SECTION Nº1 (12 DELIVERY UNITS)
INTERNAL STATION TRANSHIP DRAYS
NORTH CONVEYOR
LOCK-UP
LOCK-UP
FLAT RUNWAY Nº 3
FLAT RUNWAY Nº 1
NORTH FLAT TRAVERSER RUN
FLAT STORAGE PIERS
SOUTH FLAT TRAVERSER RUN
FLAT RUNWAY Nº 4
FLAT RUNWAY Nº 2
WAIT ORDER DECK
DRAY LOADING SECTION Nº4 (12 DELIVERY UNITS)
DRAY LOADING SECTION Nº2 (12 DELIVERY UNITS)
INTERNAL STATION TRANSHIP DRAYS
SOUTH CONVEYOR
DELIVERY LOADING SECTION OF SHED
SORTING SECTION
NOTE : ONE 30 cwt OVERHEAD ELECTRIC TRAVELLING CRANE SPANNING THE WHOLE OF THE RECEIVED SHED i.e WAGON DISCHARGING SORTING & DELIVERY SECTIONS

Figure 2.

1. That there was scope for elimination of waste time and effort both by improvement in the organisation of the work and introduction of mechanical aids.

2. That sorting has a detrimental effect upon the balance of the gang work and the weight of the barrow-load, which becomes more pronounced as the size of the shed increases.

3. That a disproportionate effort was incurred by a man in moving himself and his barrow with only about 1 1/2

cwts. and that there was totally unproductive effort entailed in empty barrow running, both of which could be materially reduced by moving the traffic in bulk from point to point in the goods shed by mechanical means.

4. That waste time and unproductive effort is caused by lack of balance between the different sections of work, resulting in one member or another of a shed gang waiting for the others, which can be avoided by the creation of « reservoirs » of work to ensure a continuous and steady supply of work.

5. That the need for carrying a staff sufficient to meet the heavy evening « peak » of forwarded traffic, results in uneconomic working, and that this can be very substantially reduced or entirely eliminated, if arrangements are made to utilise the services of the town carter to assist the shed staff in the discharge of the town collection vehicle direct to wagon.

6. A corollary to this direct loading method is that the check on the loading of goods into the wagons is made more effective. There is no need for a third party in the shape of a porter with the consequent liability for the checker's instructions as to loading to be misunderstood, or not efficiently carried out.

7. That there should be the maximum freedom of movement about the shed both by the absence of physical obstructions (whether in the shape of roof supporting columns or conflicting movements of numerous trucking units passing in various directions simultaneously over the shed decks) and the presence of an ordered sequence of operations.

As a consequence of the extensive research, the L.M.S. Company has recently constructed two new goods sheds, one at Birmingham, Lawley Street, and the other at Derby, St. Mary's, each representing a fundamental departure from orthodox methods.

For convenience I propose to deal with each station separately, and will take Birmingham, Lawley Street, first. Before doing so, however, I should explain that the nature of the traffic dealt with at two stations differs, inasmuch as at Birmingham the preponderance is town traffic, whereas at Derby the bulk of the traffic is for transhipment, and these differing circumstances necessitated different methods of treatment.

BIRMINGHAM — LAWLEY STREET.

In figure 1 of Birmingham, Lawley Street, you will observe the sheds is divided into two sections, the southern dealing with « Forwarded » traffic, and the northern with « Received » traffic.

I will deal with each separately, taking the « Received » section first. The main features of this section are the two

Fig. 3. — Birmingham, Lawley Street « Received Section », West end.

conveyors, by means of which traffic unloaded from the wagon is distributed (*a*) to internal station drays — for the reception of transhipment traffic; and (*b*) to « flats » — for the reception of traffic for town delivery.

Each conveyor runs at 40 feet per minute, and is served by two wagon roads, each holding ten vehicles. The loaded vehicles are positioned by electric capstan and traffic is unloaded from one road alongside each conveyor at a time the packages being placed on the conveyor, label uppermost, opposite the door

of the wagon. As each raft of wagons is discharged the empty vehicles are withdrawn by capstan and a fresh supply of loaded wagons worked into the shed by the same means. The staff are not, therefore, kept waiting for work whilst a shunt is made, and the distance the goods have to be manhandled is a matter of feet only.

At the end of each of the two con-

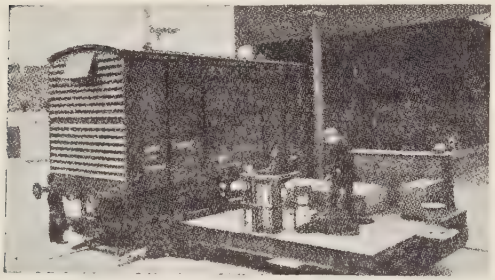


Fig. 4. — Birmingham ,Lawley Street. Wagon traverser.

veyors (see figure 2) the traffic is sorted — on one side of the conveyor into four main divisions for transhipment traffic, and on the other side, into four main divisions for delivery in the Birmingham area.

The transhipment traffic is transferred from the conveyor to internal station drays (eight to each conveyor) which are specially designed pneumatic-tyred vehicles, and which are hauled by an electric tractor to the reservoir at the end of the forwarded wagon roads.

Traffic for town delivery is transferred from each conveyor to what are termed « flats » carrying an average of 25 cwts.

There are four pairs of flats to each conveyor, each pair serving one of the four sections of the town delivery units. Each of these sections has twelve delivery units, the total number of delivery rounds being 48.

As traffic from either of the two conveyors may be for any one of 48 delivery rounds, it is necessary that the flats should be capable of being transported to any one of the four dray loading sections. This is accomplished by flat traversers of which there are two working backwards and forwards along each traverser run.

The flat traversers are able to project a « U » shaped arm underneath a flat, elevate it, retract the flat on to its own carriage, travel with it and deposit it either at one of the two dray loading sections in line with the particular conveyor the traverser serves; or alternatively, the flat can be projected the opposite way and deposited on a series of central piers from which point the second traverser can pick the flat up. By this means a flat loaded at one conveyor, but required at a dray loading section in line with the other conveyor, is transferred to the appropriate dray loading runway. Let me give you two examples.

I will take the north conveyor. You will observe that the flat positions are numbered in pairs, 1, 2, 3 and 4, and, as I have previously indicated, they serve the four final sorting sections

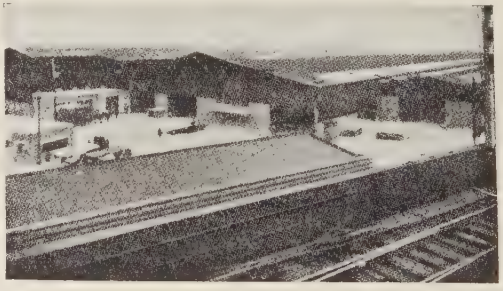


Fig. 5. — Birmingham, Lawley Street. View from S.W.

which are similarly numbered 1, 2, 3 and 4. Let us assume that a No. 1 flat is loaded ready to move to its section (No. 1). A traverser picks the flat up (position 1A on diagram, figure 2) and proceeds with it along the north traverser road to a point opposite the far end

of section No. 1 (position 1B). Here the traverser deposits the flat on to the flat runway (position 1C). The flat is then moved under control of the dray loaders by a creeper chain conveyor along the runway (to position 1D) past the twelve town delivery units on to which the appropriate traffic is loaded. When the flat has passed all the delivery units and is empty, the traverser picks

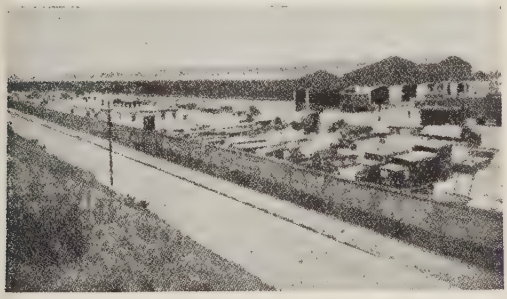


Fig. 6. — Birmingham, Lawley Street. View from S.E.

it up (position 1E) and returns along the traverser run to the conveyor terminal where the empty flat can be placed in any vacant position, not necessarily a No. 1 position, or on to the storage space for subsequent transfer to either of the conveyor terminals.

For our second example, we will suppose that a No. 4 flat is loaded ready to be taken to its final sorting section (No. 4) which you will observe is situated on the opposite side at the end of the shed. The flat is picked up by the north traverser (position 4P) and placed on the flat storage space between the north and south traverser runs (position 4Q) where it is picked up by the south traverser (position 4R) and taken to a point at the end of section No. 4 (position 4S); here the traverser places the flat on to the flat runway (position 4T). The loaded flat proceeds along the runway under the drayloader's control, as in the case of the previous example.

It is pertinent to point out here that there is no empty running by the traversers because when they put down loaded flats they pick up and return with empty ones.

Figure 3 shows how the flats are carried on runways cantilevered out from the deck. In the foreground are flats being loaded from the conveyor, and in the middle distance a flat traverser. You will also observe the central flat storage piers and the 30-cwt. electric travelling crane which spans the whole section and is used for dealing with any heavy or bulky articles which are unsuitable for conveyors.

Before commenting on the forwarded side, may I draw your attention to the wagon traverser track (see figure 1) which runs outside the shed right across the received and forwarded section approach lines. The traverser (see figure 4), which is of 20-ton capacity, is self-propelled, and is also fitted with a capstan by which it can pull a wagon out of the shed on to the traverser, carry it in either direction, and deposit the wagon on any line required. The traverser has various uses. For example,

Fig. 7. — Birmingham, Lawley Street. View from overhead walkway.

it can take a wagon which has been unloaded in the « received » section and put it on one of the forwarding lines to be placed in position for loading outward traffic, and it may be used to assist in marshalling loaded wagons in train order.

Now let us look at the « forwarded » section (cf. figure 1). Here you will notice there are eight wagon roads inside the shed on which 203 rail vehicles can be set, and except for a small sorting deck at the end of the shed for dealing with a comparatively small number of very miscellaneous or awkward loads, trucking, and reduces the risk of claims through damage or loss.

You will remember that I stated that the transhipp traffic is sorted at the end of the two conveyors to internal station drays, each of which represents a pair of wagon roads in the forwarded section of the shed. As soon as the vehicle is

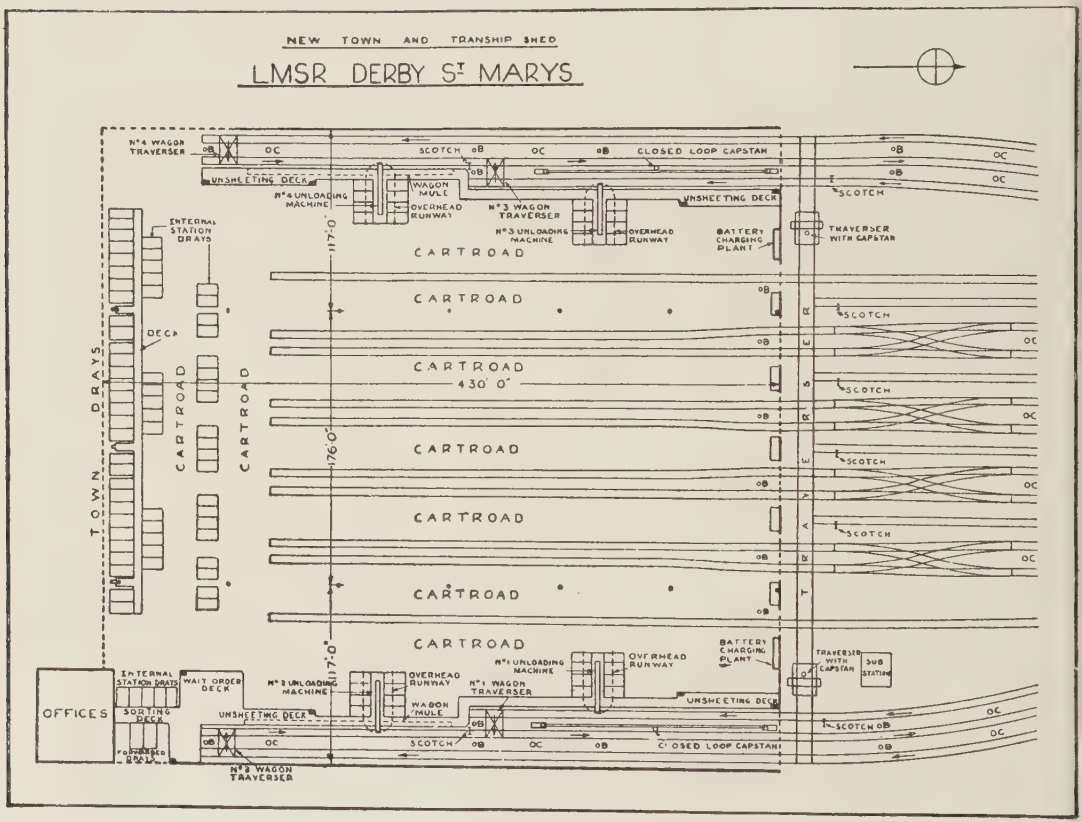


Figure 8.

no decks are provided. Alongside the wagon roads are paved cart roads, and the carter or motorman who collects the goods from the Birmingham traders takes his vehicle directly alongside the appropriate rail vehicles for the loading of the traffic. The employment of this method eliminates any need for hand loaded it is taken away by a tractor to the end of the forwarded section, and an empty dray is set by hand in its place. For convenience of handling, traffic is loaded only one tier high on the internal drays. Subsequently, horses with light tubular shafts are attached to the drays by an automatic coupling arrange-

ment and the vehicles are drawn alongside the rail wagons and the traffic loaded direct for dispatch.

At the end of the shed there is a small two-storey office, from the upper floor of which a walk-way is provided to give a good general view of the shed for the purpose of supervision.

Specially designed battery-operated road mobile cranes of 25 cwts. capacity are employed for the loading of heavy items, an the jibs of these appliances can be lowered to the horizontal so that they can pass inside rail vans with a load on the hook.

The whole shed roughly forms a rectangle of about 650 feet long by 350 feet wide and covers an area of approximately 5 1/4 acres.

An impression of its size can be gained from figures 5, 6 and 7.

The shed, where some 11 000 000 packages will be dealt with in any one year, has been constructed to meet operating requirements, the whole lay-out being determined by the methods I have described for the handling of goods. For example, the « forwarded » section required a number of roads where the road vehicles, as I have indicated, can be taken directly alongside the rail vehicles. As you will realise, the maximum unobstructed space is desirable, and to achieve this the main section of the roof is in one span of over 151 feet, with columns at 50-ft. centres.

The roof of the shed is made of metal, except where patent roof glazing is provided. This glazing is equal to 30 per cent of the floor area and has been placed to provide the highest intensity of natural lighting at the points where this is required. In the provision of electric lighting the same consideration has ruled.

The floor is laid with concrete and has suitable falls to permit of ample drainage when the cart roads are hosed. An adequate telephone system has been installed to facilitate the general working.

DERBY — ST. MARY'S.

This shed (see figure 8) covers an area of just over 4 acres, being about 430 feet long by 410 feet wide. The roof is in three spans only, two of 117 feet each with a centre span of 176 feet. The shed is designed to deal with about 650 tons of transhipment traffic daily, together with 150 tons of miscellaneous traffic for delivery in the town, and 125 tons of miscellaneous traffic collected from the town.

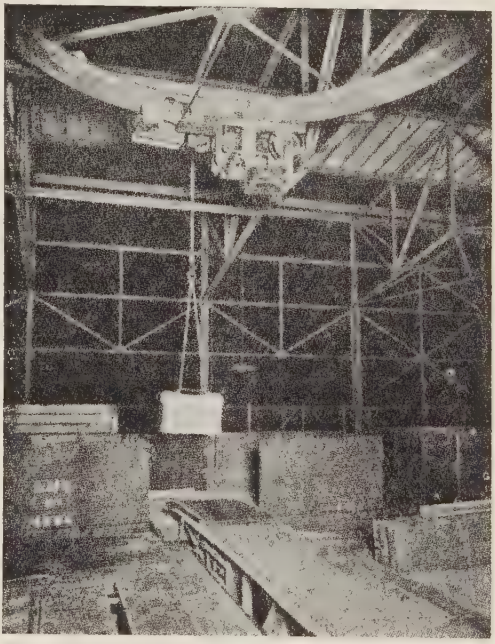


Fig. 9. — Derby, St. Mary's. View of overhead electric runway hoist block lifting heavy article from open wagon at the machine unloading point.

You will observe a different lay-out has been adopted for Derby where the inwards rail wagons are dealt with on the two outer sides of the shed, whilst the ten siding used for outwards traffic are placed in the middle.

In the first place I will deal with the inwards traffic, and as the operations on

both sides of the shed are identical, I need only describe one side.

The unloading of the rail wagons is performed with the assistance of wagon unloading machines.

Dealing first with wagon unloading machine No. 2, the loaded wagons, after being set in the shed, are moved forward, singly, by capstan to No. 2 wagon traverser. They are then traversed to the road alongside No. 2 unloading machine and moved forward past the unsheeting deck to the unloading machine, this latter movement being effected by a mechanical wagon mule with an arm which engages the wagon buffer and enables the wagons to be positioned accurately opposite the unloading machine. This wagon mule is under the control of the wagon unloading staff. After unloading, the wagon is then passed forward on to the empty road by means of a standard type fixed head capstan.

A somewhat similar procedure is adopted in the case of wagons for unloading machine No. 1, except that the final movement to the unloading machine is by closed-loop capstan which is a power driven endless wire rope controlled by press buttons.

The unloading machine is set at right angles to the wagon road. The machine consists of a power-driven belt from which packages run on to a series of gravity rollers. The machine is capable of entering the doorway of each rail vehicle. As the packages pass along the machine, they are identified and sorted to one or other of specially designed pneumatic-tyred internal station drays, eight of which are ranked round each machine. Three of these drays represent traffic for the three main areas into which the town of Derby is divided for delivery purposes, and five represent transhipment traffic for the respective wagon loading sections.

Articles which are too heavy for manhandling along the unloading machine are dealt with by overhead electric hoist block (see figure 9) capable of lifting direct from rail wagon to dray. The drays when loaded are hauled by tractors to the end of the shed (see figure 8) where the drays containing traffic for delivery in the town are ranked behind a narrow deck six feet wide, and the drays containing transhipments are ranked behind the buffer stops of the forwarded wagon roads, a steady reservoir of work being thus provided for the dray-loaders loading traffic for delivery in the town, and for the staff loading traffic to the outwards wagons.

The three main divisions of town traffic are now sub-divided in each case to nine or ten individual delivery round vehicles, whilst the dray loads of transhipments are hauled by horses, with patent light tubular shafts which automatically couple to the drays, alongside the wagons where the traffic is loaded for dispatch. Each transhipment loading section comprises two wagon roads of 16 wagon lengths with an intervening cartway.

Fig. 10. — Derby, St. Mary's. General view of wagon feeding arrangements serving wagon unloading machine.

The collection units bringing traffic in from the town for dispatch also go

straight to the wagons, as they do at Lawley Street.

The traffic is moved about the shed with loads of more than a ton as compared with perhaps 1 1/2 cwts. with hand barrows.

The outwards wagons are set in marshalled order as far as possible to minimise subsequent shunting, and across the mouth of the shed two self-propelled 20-ton wagon traversers, each carrying its own capstan, are provided to assist in the setting and re-setting of the forwarded wagons. Ample accommodation is provided outside the shed for the temporary storage of both loaded and empty wagons.

Figure 10 will be of interest as it shows a general view of the interior of the shed with a wagon traverser in the left foreground and the closed loop capstan.

CONCLUSION.

These two goods stations are the first examples in this or any other country of the adoption on a large scale of new and improved methods of handling rail-borne miscellaneous goods traffic.

What has been done by the L.M.S. in these two new large goods sheds may not be final and there may still be other improvements in lay-out to be effected, but there is no doubt that they do in themselves represent a marked advance on the methods hitherto followed.

[656. 256. 3 (.73)]

Automatic block with spring switches.

(*Railway Age.*)

By including spring switches at all of the 22 principal sidings, the new Central of Georgia installation of automatic block signaling on 120 miles of single track between Columbus, Ga., and Sterrett, Ala., not only increases safety but effects a maximum saving in train time for this form of signaling. This railroad has been a pioneer in the design and application of signaling in which train movements are authorized by signal indication rather than by timetables and train orders, such a system having been placed in service in March, 1924, on 4.5 miles of single track between Macon, Ga., and Paynes, and on 23.6 miles of single track and 5.1 miles of double track between Macon and Fort Valley in April, 1927. This was before the term centralized traffic control was first applied to such signaling, and since that time many extensive installations have been made on numerous railroads now totaling more than 6 000 miles of track.

The first proposal for the Columbus-Birmingham territory in 1943 was to include provisions for the dispatcher to control signals at the sidings for authorizing train movements by signal indication, similar to the Macon-Fort Valley section, and to more modern projects on other railroads. This proposal, however, was not approved by the War Production Board, though it did authorize straight automatic block signaling.

Accordingly the Central of Georgia decided to plan the automatic block so that it would not only provide safety but

Eastbound train at east end of siding at Smiths.

also increase track capacity as much as possible. No reductions were made in the number of open offices or hours during which offices were open. Therefore, the maximum that could be expected from timetable and train order operation was retained. Furthermore, spring switch mechanisms were installed at 41 passing track switches to save time for trains when departing from these sidings.

Just west of Columbus, the railroad crosses the Chattahoochee river, and the grade ascends westward at varying rates up to 0.85 per cent for about 6 miles. The ruling grade eastward, about 5 miles long, ranging from 1.00 per cent to 1.28 per cent, extends from Sylacauga to Trammells, and includes 15 curves, of which two are 4 deg., one is 5 deg., and five are 6 deg. Except for these two grades, the railroad is on rolling grades with comparatively easy curvature for the remainder of the mileage between Columbus and Sterrett, 113 miles. Between Sterret and Birmingham, 34 miles, the railroad passes through rough mountainous country, including long heavy grades and two tunnels. Automatic block was previously in service on this end, so that the entire engine district of 154 miles between Columbus and Birmingham is now equipped.

Spring switch with facing-point lock.

This engine district is part of two through routes : 1) between Birmingham and Savannah, Ga., via Macon; and 2) between Birmingham and Albany, Ga., via Americus. In connection with other railroads beyond its lines, these parts of the Central of Georgia are links in the operation of through passenger and freight service between Chicago, St. Louis, Kansas City, Memphis and Birmingham, on the one hand, and Savannah, Jacksonville, St. Petersburg, Miami and other Florida points on the other. The « City of Miami », a lightweight high-speed passenger train with a Diesel-electric locomotive, is operated in each direction every third day. The « Seminole », a passenger train with conventional cars and a steam locomotive, is operated each way daily. The through business on this train recently has required about 17 cars, and, therefore, a second section, to handle local traffic, is operated each way daily. Another local passenger train each way brings the total to six daily, in addition to the « City of Miami » every third day.

Traffic over the line.

Four scheduled manifest freight trains are operated in each direction daily, and a local freight is operated each way daily

except Sunday. A local train, to and from the Roanoke branch, operates each way daily over the main line between Columbus and Opelika. Counting extra trains, about 14 freight trains and 6 to 8 passenger trains are operated daily on the section between Columbus and Sterrett. Between Sterrett and Birmingham there are numerous extra moves to handle coal from the mines, and to move extra tonnage over certain grades. During the first three months of 1946 the movement of ordinary traffic was greater than in the same period in 1945. For example, there was more fruit, lumber, merchandise, meat, live stock and coal. On a typical day recently, eight westbound freight trains included 186 loads and 272 empties, and eight eastbound trains included 647 loads and 41 empties.

Prior to the installation of this signaling, train movements were authorized by timetable and train orders, with a minimum spacing of 10 minutes between the departure of following trains from any office, and likewise freight trains had to clear the main track at least 10 minutes ahead of the scheduled arrival of superior trains. For the high-speed « City of Miami » passenger train, the clearance time and spacing was 20 minutes. Now, with the automatic block signaling, the train movements are still authorized by timetable and train orders but the signaling provides for train movements at closer spacings with safety.

Previously, all siding switches between Columbus and Sterrett were operated by hand-throw stands, whereas, as a part of the new signaling project, spring switches were installed at all of the principal sidings used for passing trains. This includes spring switches at both ends of 19 sidings. Also at the lap siding layout at Kellyton, spring switches were installed at the outlying ends of the two sidings. When leaving a siding which is equipped with a spring switch, a train pulls out and departs without stopping or waiting for a trainman to operate the switch. According to tests made on this territory, a freight train with about 40 cars totaling 2 000 tons saves about 7 to 10 minutes in departing from a siding equipped with a spring switch, as compared with a hand-throw switch. A 4 000-ton train including 55 to 80 cars would save 10 to 12 minutes or more. The variation in time depends on the local conditions, such as grades and curvature.

Keeps trains rolling.

In addition to checking track occupancy for trains ahead, the signaling detects other conditions. For example, during the first six months in service the signals detected six broken rails and two main switches that were open part way. As expressed by one engineman, « The signals are just like somebody out ahead telling me to come on, "the way is safe" ». With this confidence in the protection provided by the signals, the enginemen can keep their trains rolling at speeds which are nearer to the maximums allowed. For example, prior to the installation of signaling, the heavier passenger trains, such as the « Seminole », had difficulty in making the scheduled running time, often losing 20 to 30 minutes between Columbus and Birmingham. Now these train can hold to the schedule easily and, if necessary, make up 30 to 45 minutes.

Similarly the through freight trains, if given a clear track, can make fast time. In numerous instances when the dispatcher can get the first section of eastbound freight train No. 38 out of Birmingham 30 minutes ahead of passenger train No. 2, he keeps the freight rolling ahead of the passenger all the way to Columbus. Without the signaling, the freight train would have to take siding to let the passenger train by, so that the freight would lose 30 to 45 minutes.

The through freight trains are received from and delivered to connecting railroads for operation in through schedules, such as from St. Louis to Jacksonville with third morning arrival. Therefore, the C. of G. must operate these trains over the Columbus-Birmingham district in the allotted time, and must make up time if received late.

Red lock lamp on foundation and SS post on a turnout.

In this respect, the new automatic block signaling and spring switches have been a great help. For example, the first section of No. 29, the fast westbound freight, must be in Birmingham before 5 p. m. On occasions this train leaves Columbus from 45 minutes to an hour behind schedule. Since the new signaling was completed in July, 1945, this train has made up all the time needed so that it has not missed connections at Birmingham a single time. Similar good reports apply to other through trains. Prior to the installation of signaling and spring switches, the freight trains handling regular tonnage would ordinarily require 8 hrs. or more for the run either way between Columbus and Birmingham, and time of 7 hrs. was exceptional. Now the 2 000-ton trains make the run in about 5 hrs. 30 min. and the 4 000-ton trains in about 6 hrs. 5 min.

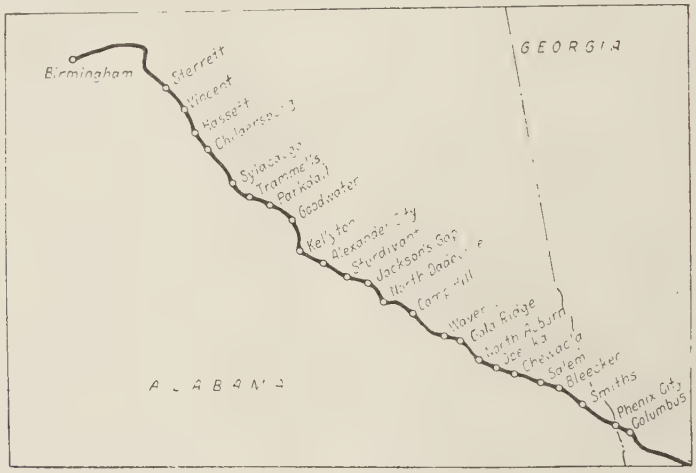
Replacing of switches.

At each location where a spring switch was to be installed, the old switch stand was replaced by a Union Switch & Signal Company Type S-21 switch movement which in reality is a hand-throw switch-and-lock mechanism including a lock rod and plunger which locks the switch just the same as at a switch in an interlocking plant. The oil-buffer spring mechanisms are the Mechanical Switchman type made by the Pettibonne - Mulliken Corporation. These devices take the place of a regular connecting rod for the switch. As applied to a spring switch the S-21 switch stand also includes an arrangement and pipe connection so that when a train starts to pull out of the siding to trail through the switch, the lock plunger is automatically withdrawn from the lock rod to permit the switch to open to allow the train to rail on through. If changes in temperature, running rail or other local conditions have changed the adjustments so that the switch does not return to its normal position with the plunger through the lock rod, then the circuits hold the mainline high signals to display the red aspect to approaching trains, and, after having stopped, the enginemen must inspect the switch before proceeding over it in the facing-point direction.

If temperature variations have changed adjustments so that the plunger goes too far through the lock rod, it might not be pulled out far enough when a train starts to trail out through the

switch from the siding. Experience proves that this overthrow occurs very rarely, but nevertheless the device is designed with contacts which detect this overthrow condition and cause a red lamp to be lighted on a small concrete foundation located opposite the fouling point on the siding.

that he has a green aspect in the station-departure head-block automatic signal, then he is reminded by the SS sign that he has a spring switch which he can trail through without stopping, providing the little red lamp is not lighted on the small foudation beyond the SS sign. This combination of information has



Map of subdivision between Birmingham, Ala., and Columbus, Ga.

When such a warning lamp is lighted, it indicates to the engineman of a train on the siding that he must not trail his train out through the spring switch, but rather the switch must be thrown by hand by a trainman. Also, as a reminder to enginemen of trains ready to depart from a siding equipped with a spring switch, there is a special marker post, with letters « SS », which is located along the siding near the clearance point, as shown in one of the illustrations.

For example, with a train on a siding ready to go, the engineman looks to see

proved to be effective in giving the enginemen confidence to pull out promptly and thereby save time.

This installation of automatic signaling and spring switches was planned and installed by the forces of the Central of Georgia under the jurisdiction of E. B. DeMeritt, signal engineer, and the field work was under the direct supervision of D. McCaleb, general signal foreman. The major items of signaling equipment, including the Type S-21 switch stands and facing-point locks, were furnished by the Union Switch & Signal Company.

[621. 132. 8 (.73)]

Geared steam-turbine locomotive, Pennsylvania RR.

(The Railway Gazette.)

The first non-condensing steam turbine locomotive to be produced in the United States has recently been placed in service on the Pennsylvania Railroad. It was constructed by the joint efforts of two firms — the locomotive being built at the Eddystone Plant of the Baldwin Locomotive Works, and the turbines and gears manufactured by the Westinghouse Electric & Manufacturing Company.

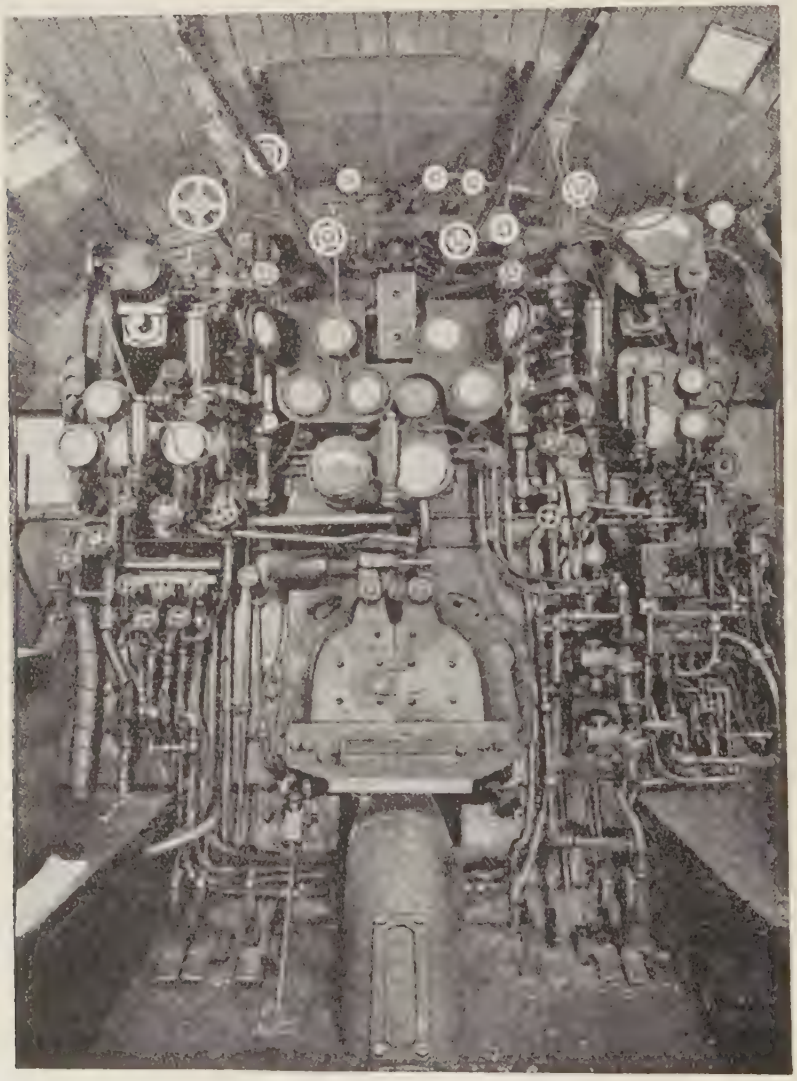
The forward turbine drives through double reduction gears and quills on two axles, and develops 6 900 h.p.

The purpose of this venture was to test the principle of turbine propulsion in practical operation, and to determine its adaptability in opening the way to higher speeds and greater operating efficiency for the steam locomotive.

Work upon this design was begun in 1941, and was originally projected for a 6 900-shaft-horse-power locomotive for high-speed freight or passenger service, this being considered the highest practicable power for a rigid-frame eight-coupled driving unit. Wartime shortages of certain materials necessitated the substitution of six-wheeled bogies for the four-wheeled types originally planned, so the wheel arrangement became 6-8-6. The locomotive was ready for service in September, 1944; it is numbered 6200 and its classification lettering is S-2 on the Pennsylvania Railroad.

The main frame of the locomotive is a cast steel bed with boiler saddle, cross-stays, brake hanger brackets, and other

details cast integrally with it. The leading bogie has a cast steel frame and outside Timken roller bearings on each axle; the trailing bogie is a six-wheeled « Delta » truck with cast steel frame, also with outside Timken roller bearings for each axle. Rolled steel wheels are used for each of these bogies. All four driving axles are fitted with Timken roller bearings; the 68-in. driving wheels are of cast steel with spoke type centres. All have flanged tyres, and are connected by coupling rods with Timken roller bearings at the crankpins.



The cab of the Baldwin-Westinghouse geared-turbine locomotive.

Westinghouse-American combined automatic and straight-air brake equipment is provided, having clasp brakes on all driving and carrying wheels, both on engine and tender.

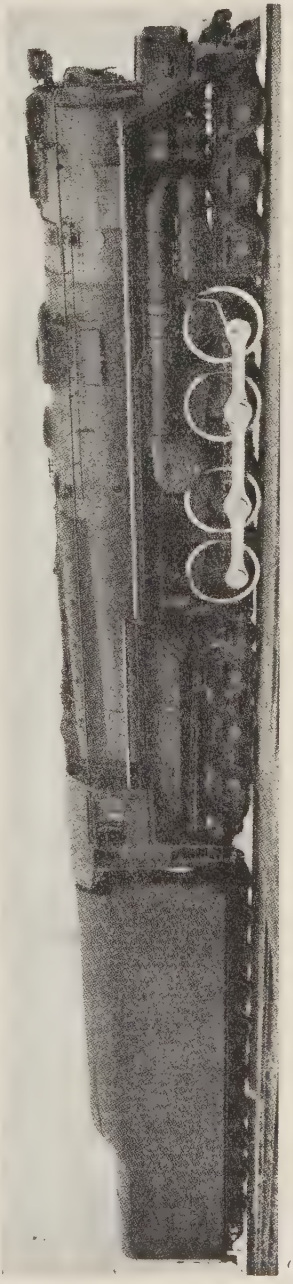
The boiler is of the modified Belpaire type 93 in. dia. outside the first course, designed for a working pressure of 310 lb. per sq. in. It is equipped with a type « E » single-loop superheater, a feedwater heater, and a mechanical stoker. The firebox has six circulators supporting a firebrick arch. The combustion chamber extends 10 ft. into the boiler barrel.

The tender, having a capacity for 18 000 U. S. gallons of water and 75 000 lb. (37 1/2 short tons) of bituminous coal, is built up on a cast-steel water-bottom frame and is carried on two eight-wheeled bogies of standard Pennsylvania design.

Propulsion unit.

The propulsion equipment comprises a forward turbine, a double-reduction gear for each of the two middle driving wheels, a flexible cap drive element between the final gear and the two middle driving axles, and a reverse turbine and gear unit « clutched » to the high-speed pinion. Both turbine units are supported from the gear case, which in turn is supported from the main locomotive frame, making the power unit a complete assembly in itself. The three-point support of the gear unit is so designed that any distortion of the locomotive frame is not transmitted to the gear case. The forward turbine, of the impulse type, consists of a Curtis stage followed by five full-admission Rateau stages. At 100 m.p.h. the turbine rotates at about 9 000 r.p.m. It is connected to the high-speed pinion at the reserve-turbine side of the unit, a quill shaft extending through the pinion.

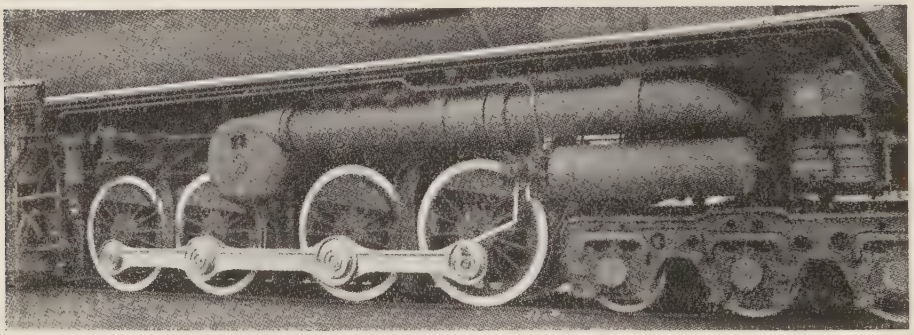
Steam enters the turbine through four 3-in. pipes, each connected to a nozzle



General view of locomotive, and diagram showing principal dimensions and weights.

group covering about 25 per cent. of the Curtis stage blading. Each inlet pipe is connected to a throttle valve and header at the top of the smokebox, and the steam flow into each pipe is controlled by cam-operated valves, arranged to open in sequence.

The reverse turbine is a single Curtis stage, overhung on an extension of the reverse-gear pinion shaft. Steam is admitted through a single inlet pipe, also cam-operated. The maximum speed in reverse is 22 m.p.h., when the turbine develops 1 500 h.p. at about 8 300 r.p.m. The maximum starting tractive force in reverse is 65 000 lb., or 25 per cent. of the adhesive weight. This high figure — in view of the small size of the reverse turbine — is achieved by the addition of the reverse gear which quadruples the reverse turbine torque at the high speed pinion. Power in reverse is transmitted to the main gear high-speed pinion through a hydraulically-actuated clutch. Engagement or disengagement of the clutch when the locomotive is moving is prevented by a « zero speed » interlock in the pneumatic control circuit. The ahead turbine is never disengaged and must therefore rotate in the « wrong » direction when the locomotive is moving in reverse.



Right-hand side of locomotive with main forward turbine.

Single lever control.

A single lever at the right-hand side of the cab is used to control the speed of the locomotive, also its direction (*i.e.*, forwards or backwards). The complete motion of the lever is the same as that in changing speeds from low gear to intermediate in a motor car. The « neutral » position of the automobile gear is the « off » position for the locomotive.

A pneumatic cylinder controlled by an air relay actuates the control gear for forward running; another is provided for movement in reverse. There is also a low-oil-pressure protection valve. If either turbine overspeeds (110 m.p.h. forwards, 25 m.p.h. in reverse), or if lubricating oil pressure falls below 5 lb. per sq. in., the protection valve operates to close either throttle by exhausting the control air to atmosphere. This control was supplied by the Westinghouse Air Brake Company.

Gearing.

The main gear is a double-reduction unit designed to transmit power to the second and third driving axles. There are two double-helical high-speed gears, two low-speed spur pinions, two low-speed spur gears, and two cup-drive elements all housed in an enclosed fabricat-

ed steel gear case. The high-speed pinion and second reduction gearing is hardened and ground; this is the first commercial application of hardened and ground double-helical gearing. The tooth loading and the contact hardness (450 Brinell) of the high-speed pinion are more than twice the values commonly used. A special method, marking a major technical advance in gear-grinding, was developed for the production of the double-helical gears. The gear case is in four sections. The centre is the chief structural member to which the forward turbine and the reverse turbine and gear assembly are bolted; the upper section forms a cover and also adds to the crosswise stiffness; the two lower sections (removable to permit dropping the axles) are lubricating-oil sumps.

Since the complete propulsion unit is supported from the spring-borne locomotive frame, the second and third driving axles must be permitted to move up and down with respect to the low-speed gears which surround them, as the locomotive moves over the rails. Moreover, this vertical movement of each driven axle must take place while it is turned by its gear. The cup drive which permits this motion is really a « misalignment coupling » between the low-speed gear and the axle. Although there is little physical resemblance, the principle is the same as the arrangement used on many electric locomotives. In addition to allowing up-and-down movements, these cup drives are torsionally flexible; this protects the gearing from shock loads.

Lubrication.

All portions of the propulsion equipment are lubricated from a common source. The oil is pumped from the gear case sump by a centrifugal pump through a magnetic strainer and filter to an oil cooler of the surface type, cooled by boiler feed water. The oil then passes to a distributing manifold equipped with a steam-heating coil before being piped to the bearings and gear sprays. High-grade turbine oil is used, having a viscosity of 500 sec. Saybolt at 100° F. The system contains about 150 gal. A regulator maintains the oil pressure constant at 15 lb. per sq. in. on bearings and sprays.

Due to its turbine drive, the locomotive has uniform torque at all speeds, similar to that of electric and diesel-electric locomotives. The tractive power of the turbine locomotive exerted at the rail exceeds at pratically all speeds that of a conventional steam locomotive having equal boiler capacity and adhesive weight. It also exceeds the tractive force of a 6 000-hp. diesel-electric locomotive at speeds above 40 m.p.h., with a considerable advantage at speeds above 50 m.p.h.

At speeds above 30 m.p.h. the steam consumption of the turbine locomotive per horsepower at the rail is considerably less than that of a comparable reciprocating steam locomotive. At starting and at very low speeds the steam consumption of the turbine is relatively high, but with modern high-speed main-line schedules, with few stops and very little operation at low speeds, this is held to be more than offset by the advantages of the turbine at high speeds. The new locomotive has been undergoing tests on the Pennsylvania Railroad in both passenger and freight service. Continued operation in revenue-producing service is contemplated, to prove fully the mechanical adequacy of the design.

We append herewith the leading dimensions of this locomotive. For information contained in this article we are indebted to Mr. R. P. Johnson, Chief Engineer of the Baldwin Locomotive Works, and to our contemporary *Railway Mechanical Engineer*, for details given in its March, 1945, issue by Mr. Newton and Mr. Brecht, of the Westinghouse Electric & Manufacturing Company.

Leading dimensions.

Coupled wheels, dia.	68 in.
Boiler pressure, per sq. in.	310 lb.
Boiler dia. largest (outside)	102 in.
Firebox, length	180 in.
Firebox, width	96 in.
Combustion chamber length	120 in.
Net gas area through tubes	11 sq. ft.
Length over tube plates	18 ft.
Grate area	120 sq. ft.
Evaporative heating surfaces :	
Tubes (49.2 1/4 in. dia.; and 235.3 1/2 in. dia.)	4 378 sq. ft.
Circulators	84 sq. ft.
Firebox and comb. chamber	530 sq. ft.
Total	4.992 sq. ft.
Superheating surface	2 050 sq. ft.
Combined total	7 042 sq. ft.
Tractive effort, forward	70 500 lb.
Tractive effort, reverse	65 000 lb.
Adhesion weight	260 000 lb.
Weight of engine in working order	580 000 lb.
Water capacity of tender	18 000 gal.
Fuel capacity of tender	75 000 lb.
Weight of tender	412 900 lb.
Total weight of engine and tender	992 900 lb.
Wheelbase, driving	19 ft. 6 in.
Wheelbase, bogies	13 ft. 6 in.
Wheelbase, engine, total	53 ft. 0 in.
Wheelbase, engine and tender, total	108 ft. 0 in.

Turbine characteristics.

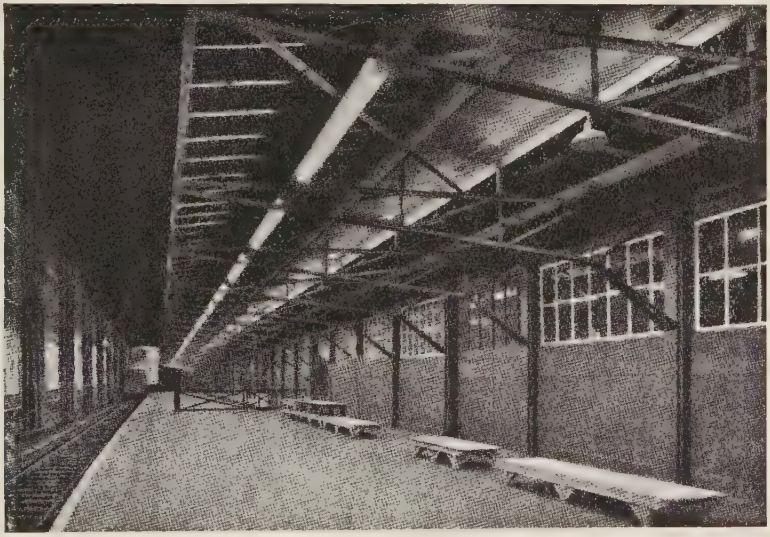
Steam conditions :	
Pressure at turbine inlet	285 lb. per sq in.
Steam temperature at inlet	750° F.
Back pressure at turbine exhaust	15 lb. per sq in.
Ahead turbine :	
Nominal rated capacity	6 900 h.p.
Maximum turbine operating speed	9 000 r.p.m.
Overspeed governor controlling speed	10 000 r.p.m.
Reverse turbine :	
Nominal rated capacity	1 500 h.p.
Maximum turbine operating speed	8 300 r.p.m.
Overspeed governor controlling speed	9 100 r.p.m.
Main reduction gear:	
High-speed ratio	31 : 160
Low-speed ratio	31 : 111
Total reduction	18.5 : 1

656. 215 (.42) & 625. 233 (.42)]

Fluorescent lighting developments.

(The Railway Gazette.)

The production of fluorescent tube lighting of the high-tension, cold cathode type virtually came to a stanstill during the war. Previously, on account of its possibilities both as a decorative and highly efficient illuminating medium, it was fast replacing tungsten filament lamp in stores, hotels, cinema and theatre foyers, and many other places where a cheerful and colourful atmosphere was needed.



Fluorescent tube lighting on the Continental platform at Victoria Station, Southern Railway.

Tube lighting at railway stations.

In 1937 Osram fluorescent tubes of this type were installed for the first time at Malden Manor, Tolworth, Chessington North, and Chessington South Stations, Southern Railway. This was the first time that such a light source had been used in any railway station in the country. In all these installations, tubes of two colours — light blue and pink (or gold) were used, producing a warm, cheerful effect and adequate light of good quality.

Now that restrictions on production have been removed, the installation of high-tension fluorescent tube lighting is moving apace all over the country. One such installation is that recently introduced on the Continental platform at Victoria Station, Southern Railway. Here, 96 Osram fluorescent tubes, giving an intermediate white quality light (midway between the « daylight » and « warm white » colours) are arranged in two lines each covering 250 ft. of

platform. They are spaced 8 ft apart and mounted under a canopy 14 ft. high. Each line comprises 24 units butted together to form a continuous run. Two standard 8-ft. 6-in. tubes are used in each unit.

One line of tubes is positioned near the edge of the platform to provide adequate lighting for passengers getting in or out of trains; the other line gives general illumination on the platform, and lights the benches used by the Customs offices. This system gives even illumination, with minimum shadow, over the whole of the platform, and is proving a great help to the railway staff and the Customs officials, whose task in searching baggage is considerably facilitated. This will be readily understood in view of the fact that the new lighting provides four times the illumination which was obtained with the original lighting system. The total loading is 4 1/2 kw. The scheme was prepared by the Illuminating Engineering Department of the General Electric Co. Ltd., to the requirements of Mr. A. Cunnington, Southern Railway Lighting Engineer.

A feature of this form of fluorescent lighting is that there is no time lag between switching on the current and the lighting of the tubes. The tubes have a long life and there is only small depreciation of light output. Even when allowance has been made for this depreciation, the resultant intensity will still be considerably higher throughout the life of the tubes, than that given by the original system of lighting. The installation of the tubes, transformers, and high-tension wiring was carried out by Claude-General Neon Lights Limited, and the low-tension wiring was undertaken by Southern Railway engineers.

Fluorescent lights in Underground coach.

Fluorescent lighting is equally suitable for providing even and adequate illumination inside a railway coach. The system has been adopted in the experimental car placed in service by London Transport early this year (see our February 1 issue), which was designed as a basis for the new stock to be provided on the forthcoming electrification to Amersham. The lighting is provided by Osram « warm-white » fluorescent lamps. These are operated from an a.c. source with a periodicity of 1 200 cycles. This relatively high frequency not only allows the use of small chokes, but permits automatic starting without the use of a starter switch, eliminates the stroboscopic effect, and also improves lamp efficiency. Elimination of the starter switch reduces maintenance, which is an attractive feature to transport undertakings.

London Transport experimental car with fluorescent lighting.

In order to use fluorescent lamps, it was necessary to instal a motor alternator to provide high-tension a.c. This

alternator is of the inductor type, and is driven from a motor running off the 600-volt d.c. traction supply. It is designed to feed two coaches, and since only one is at present in use, an additional choke enables it to run at half load.

Extensive experiments on the District Line of London Transport with d.c. operated fluorescent lamps had enabled the Board's engineers to overcome the difficulties of installation and maintenance, and to ascertain the fitness of this type of lighting for Underground trains. In these experiments, also, 20-watt Osram « warm-white » fluorescent lamps, each 2 ft. long by 1 1/2 in. dia. had proved quite satisfactory, and, therefore, lamps of the same size and wattage are used in the a.c. installation.

They give just the right amount of light for uniform illumination throughout the coach, and have a sufficiently low surface brightness for them to be used unscreened. There are twenty-four fluorescent lamps altogether (eight in each compartment) providing an initial illumination of 10-15 lumens per sq. ft. at 2 ft. 6 in. from the floor. They are mounted in fittings designed by London Transport, and harmonise well with the general design and decorative schemes of the coach.

Compared with a tungsten lamp installation of equivalent light output, the heat generated by these Osram fluorescent lamps is much lower, and this is a valuable feature from the passengers' point of view, especially during the rush hour periods when crowding is prevalent.

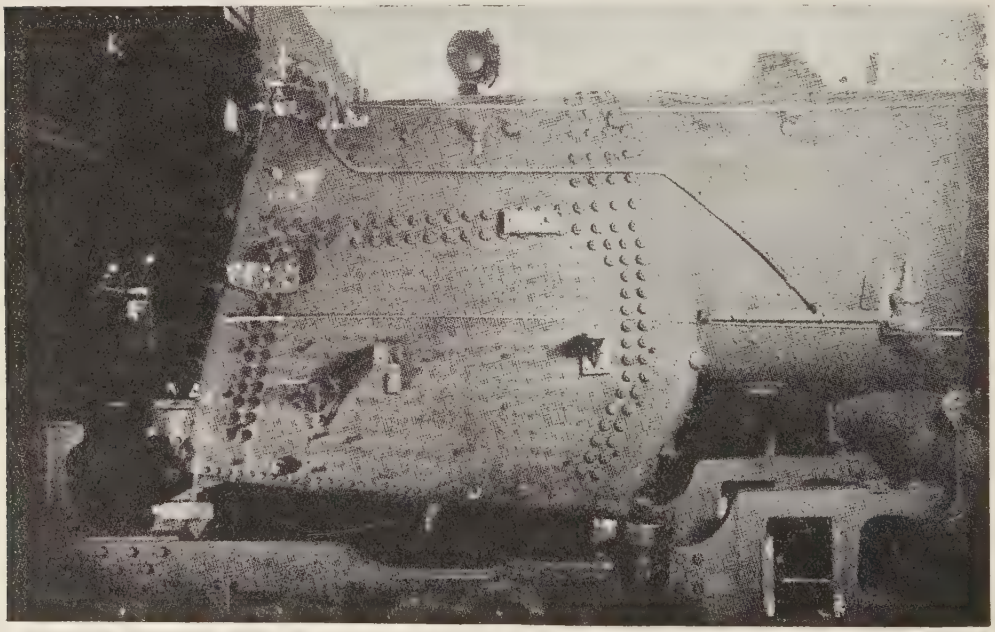
Throughout all the experiments associated with this coach, the General Electric Company has been in close collaboration with London Transport, and with Metropolitan Vickers Limited, which firm was responsible for the design of the motor alternator.

[621. 133. 3 (.73)]

Alco all-welded boilers.

(Railway Mechanical Engineer.)

Anticipating an increasing demand for all-welded boilers, the American Locomotive Company has installed at its Schenectady, N. Y., plant the welding, stress-relieving and inspection equipment that permits this builder to meet the exacting requirements for the fabrication of boilers by fusion welding. This equipment is designed as well for the improvement of the welding facilities that were used in making the all-welded boilers already in service and for the placing of the production methods on a more efficient basis.

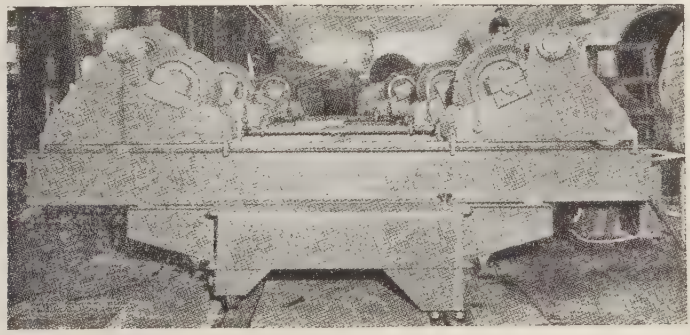


Firebox end of all-welded boiler completed early in 1946 for the Canadian Pacific.

In every phase of the welding process, from operator and procedure qualifications to final inspections, the practices are designed to meet or exceed the American Society of Mechanical Engineers' locomotive boiler code provisions. Prior to 1946 the one essential part of the equipment that was lacking at the Schenectady plant, and which was required for the observance of these code requirements, was a furnace of sufficient capacity to stress-relieve a complete boiler. The first all-welded boiler, built for the Delaware & Hudson in 1937 by the American Locomotive Company was stress relieved at the Chattanooga, Tenn., plant of the Combustion Engineering Company, Inc., because the Alco furna-

ces were too small for a complete boiler. Now the Schenectady shops have a furnace capable of holding the largest boiler. In addition, special equipment for use during automatic-welding operations has been installed. These new features supplement the testing laboratory, X-Ray and automatic-welding facilities that have been available for some time.

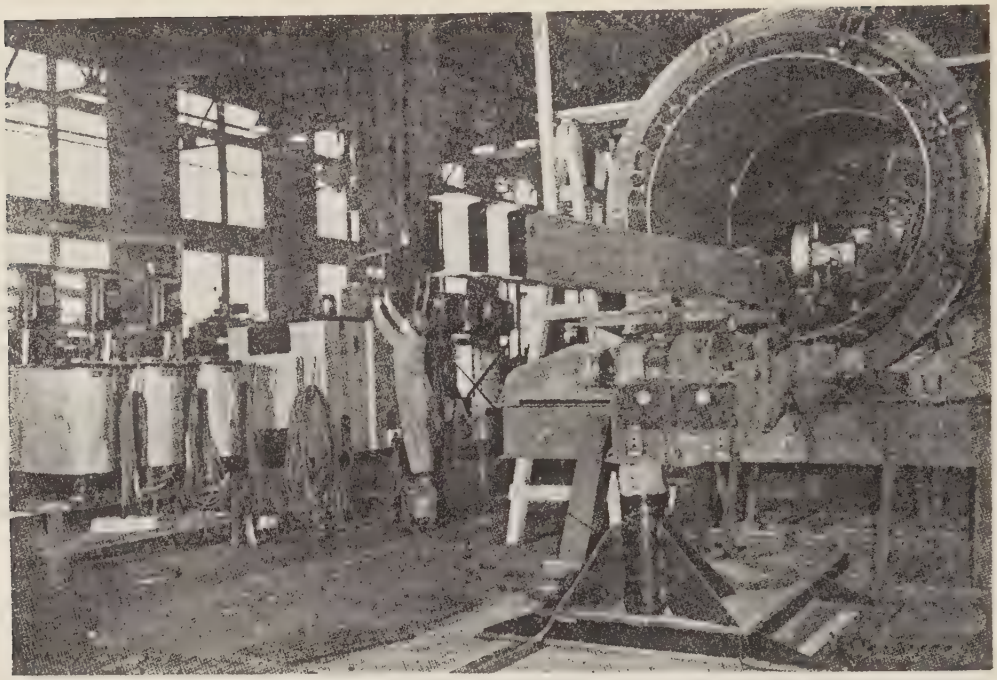
Starting plate is at the left and a test coupon at the right of completed longitudinal weld.



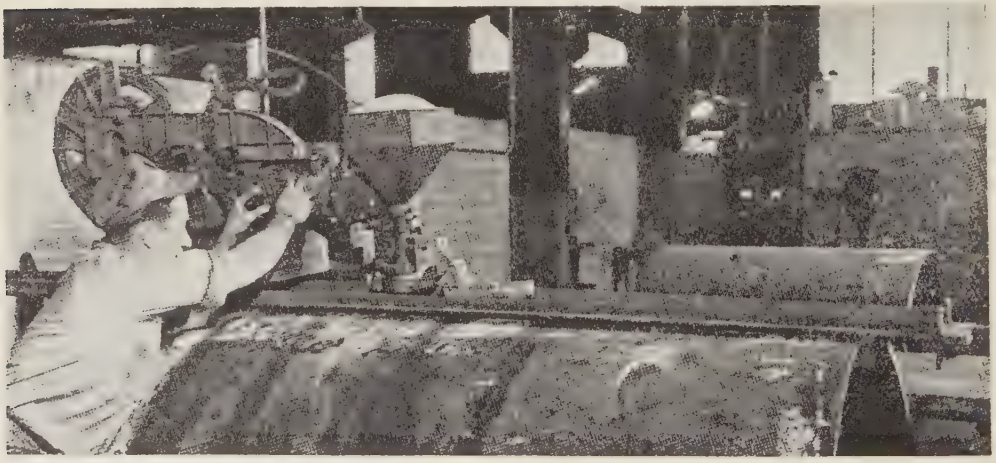
New rolls for rotating the boiler courses during the welding of the girth seams.

To describe the welding equipment, the methods used in the construction of one of the two all-welded boilers delivered to the Canadian Pacific early in 1946 will be explained in the sequence in which they were used. First, procedure qualification and operator qualification tests must be made and approved before the actual boiler fabrication can be started. Procedure qualification determines the suitability of the welding technique employed in the shop and covers the welding apparatus, electrodes and plate material. After the welding technique is approved, tests are made to establish the operator's ability to produce sound welds under conditions similar to those that will exist during the actual welding of the boilers. At Schenectady, permanent records of the procedure and operators qualification tests include certified forms giving all pertinent data, and photographs of tests specimens with identifying markings made after the tests were completed.

In the forming and fitting-up of the plate prior to welding, a maximum tolerance of 0.015 in. is permitted in the



General arrangement of the equipment for the welding of the girth seams. — This weld is being made with the boiler on the old rolls with which the compensating ring was used. — A technician at the isolated controls guarantees the constancy of voltage and amperage for the welding process.



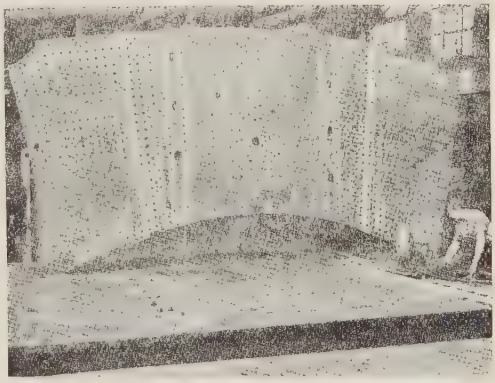
Welding a longitudinal seam. — The first pass is made on the outside, the second and last pass on the inside.

gap between the edges. This precision is particularly important because automatic welding, unlike manual welding, can not be changed continually to accommodate varying conditions — and automatic welding is utilized wherever possible because it produces a more uniform and better weld. The fit-up with the 0.015-in. tolerance is assured on the longitudinal seams by machining the edges on plate planers. After the longitudinal seams are welded, the faces of the circumferential seams are trued by grinding to permit the close fit-up of the girth joints. Clean-up grinding of the plates edges is also done in order to minimize repairs. The plates are held in position within the tolerance limit by means of bolts that are slipped through nuts tack welded to the inside of the courses and then tightened. After being drawn into position by the bolts the edges of the plate are tack welded to maintain the fit-up during the welding process.

Welding of seams.

The outside of the longitudinal seam is joined in one pass by automatic welding equipment moving on tracks laid along the seam. During this operation the mechanic's helper holds a copper back-up on the inside of the course as a precaution against a possible blow-through. The inside of the shell-course seam is welded in the same manner after the bolts and tack welds are removed. It should be noted that small plates attached to the course at the ends of the seam are used for starting and stopping the welding process, and at one end the plate becomes a test specimen. A test specimen for each longitudinal weld is prepared. To meet the code requirements the plates for test samples must be from the same lot of material that is used in the boiler and must be attached to the boiler course so that the specimen's edges are a continuation of and a duplication of the corresponding edges of the longitudinal joint. Furthermore, the weld metal must be deposited in the test plates continuously with the weld metal in the longitudinal joint. After the welds are completed both sides of the seam are ground and the outside marked off for X-ray, the procedure for which will be explained later.

The welding of longitudinal seams at Schenectady is one phase of the welding operation that the American Locomotive Company had developed on a production basis during the war. In 1944 a bottleneck existed in the bull-riveting capacity at this plant, a condition that was delaying the production of several hundred boilers for the Russian government. To expedite the work permission was obtained to weld the longitudinal seams of these boilers and this experience has been particularly valuable in the setting up of the equipment and procedures for all-welded boilers.



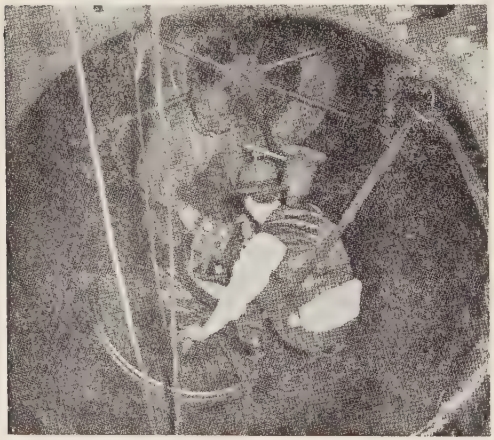
The roof sheet is welded to the side sheets flat.

The front flue sheet was welded in manually after the longitudinal seam of the first course was completed. This sheet is not joined directly to the first course but is welded to a ring and is reinforced by several gusset braces, the

design being similar to that used in the first all-welded boiler made in 1937 for the Delaware & Hudson.

The steam dome presents some difficulties to automatic welding because of its irregular shape. Even so, the repairs and the resulting distortion of the dome due to manual welding indicated the desirability for the automatic welding of this part. Consequently, a special small automatic welding machine was fitted for the job and in this particular boiler only 1 1/4 in. of the dome welds had to be repaired. The boiler was rotated as this operation progressed so that the weld was made in a level position at all times.

The roof and side sheets were laid out on a flat table and welded as a sub-assembly to simplify the fitting-up and the rolling operations.



Welding the dome with an automatic machine.

A point of particular interest in all the welding operations is the control of amperage and voltage by a technician and not by the automatic-welding machine operator. In this way the operator can concentrate on the weld in progress while the technician maintains the welding conditions, the latter being guided by the procedure established for the joints being welded.

In welding the circumferential seams for the Canadian Pacific boilers old equipment for rotating the boiler courses was used. This equipment, now replaced, consisted essentially of three sets of rollers, on which the boiler courses rested, and a power source. The power was supplied by an electric motor connected by a shaft to the back flue sheet and controlled remotely by the welding-machine operator. One of the difficulties that has to be overcome in the rotation of the boiler sheets is the eccentricity of courses such as the non-uniformly tapered dome course. This eccentricity required the introduction of a large ring around a cylindrical course in order to maintain an even welding speed. Also, when rotating the boiler with the firebox attached the off-set of the firebox sides resulted in an uneven distribution of weight throughout 360 degrees of rotation and again made the control of welding speed difficult

New means of rotating the boiler during the welding of the girth seams consist of three sets of rollers mounted on small cars that can be positioned by moving along a permanent track. One of the roller sets is powered for rotating the boiler; one is an idler set, and the third is also an idler but is designed to eliminate the need for a ring to compensate for the eccentricity of courses. This set of rollers, like the other two, can be adjusted transversely of the boiler through power drives. In addition, the third set of rollers adjusts itself automatically to changes in weight distribution due to the eccentricity of the boiler and thus it can compensate for these differences. This automatic control is obtained by the use of pressure switches.

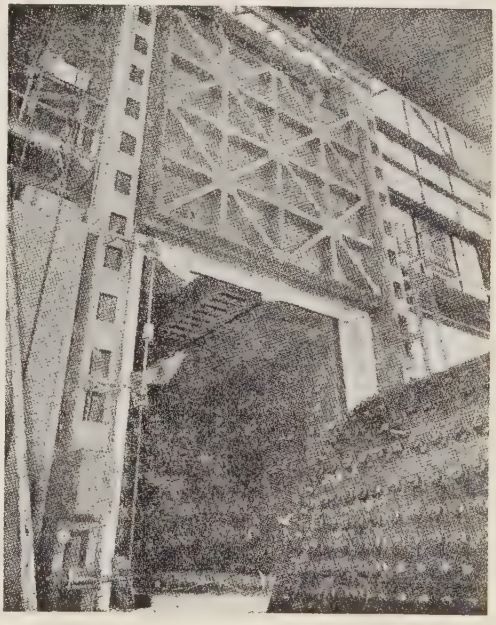
Prior to welding the girth seams the joint faces of each course are trued by a grinding machine designed especially for this purpose. This machine has

two adjustable grinding wheels, each with an individual motor drive. The center shaft of the machine and the cross member on which the grinding wheels are mounted makes a horizontal T-shaped arrangement, the wheels being mounted near each end of the top line of the tee. The grinding wheels can be moved along the cross member to suit any boiler-course diameter.

The outside of the girth seams are welded by a machine supported over the top of the boiler. The inside welds are made by a machine supported by an adjustable boom that is extended into the boiler. The welding heads remain stationary during the girth-seam welding operations while the boiler is rotated. Again, the joints are ground in accordance with the code provisions and marked for the X-raying. The grinding removes irregularities in the weld surface so that it merges smoothly into the plate surface. A maximum reinforcement of 1/8 inch after grinding is maintained, this amount also being permitted by the code provisions.

X-Ray procedure.

X-ray pictures of all outside butt-welds are made to insure the welds being free from inclusions and porosity and as near perfect as possible. Prior to the X-raying, lead numbers at 2-in. intervals on cloth strips are attached to the boiler parallel to the seams and near enough to the welds so they will show on the 4 1/2-in. by 17-in. X-ray negatives. These numbers and arrows pointing to prick-punch marks on the boiler are used to locate accurately any defects. The numbers start at the front end of the boiler for the longitudinal seams and, facing the front of the boiler, they run clockwise from the longitudinal welds for the girth seams. The prick-punch marks, two per X-ray exposure, serve as a permanent means of locating defects. If a defect shows up on the X-ray negative, the negative itself is placed on the boiler and positioned exactly by placing the prick-punch marks on the negative over those on the boiler. Then a center punch driven through the defect showing on the negatives places a prick-punch mark on the weld at the location of the defect. This particular procedure for locating defects on welded boilers is a direct result of experience obtained in the production of combat tanks during the war.

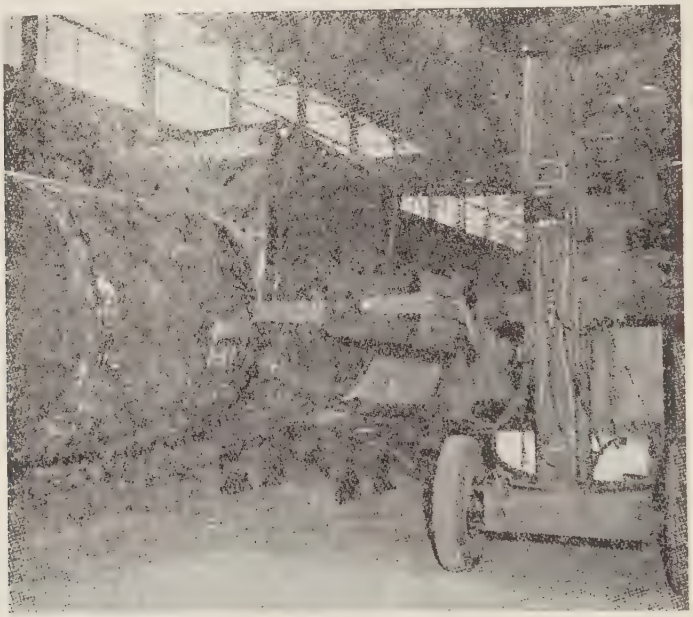


The stress-relieving furnace.

Each negative shows a 15-in. section of the longitudinal weld which permits a 2-in. overlap of each picture because the negatives are 17-in. long. The girth seams are X-rayed in 8-in. or 10-in. sections in the same manner. The picture of the dome welds is taken by one exposure. Duplicate pictures of each weld section are made to eliminate the possi-

bility of spots on a negative being judged as defects. Alco has established a higher X-ray standard than that required by the A. S. M. E. locomotive boiler code. Any defects outside the limits of this standard are removed and rewelded. After rewelding, new X-rays are made to insure that the repairs have removed the defects.

the side of the door. The furnace is heated indirectly by four combustion chambers, each of which has four oil burners, the hot gases being distributed evenly throughout the furnace by means of fans that drive them through ducts and louvres. One burner per combustion chamber is checked by an electric-eye control which will shutt off the fuel-



X-raying the throat-sheet connection. — All outside butt welds are X-rayed to insure the detection of all defects.

The completed boiler shell is stress relieved as a unit in conformity with the code requirements. The furnace installed at Schenectady for this purpose is 80 ft. long by 12 ft. square inside. It is equipped with an electrically driven car upon which the boiler is set and the top of which is lined with fire brick, as this car becomes the bottom of the furnace during the operation of the unit. Both the car and furnace-door positions are controlled by push buttons located to

oil supply to that chamber if the flame should be extinguished. The furnace is equipped with a program control.

Program control.

This control of the furnace operation has four functions which it performs automatically. It controls the rate at which the furnace temperature is increased; it maintains the furnace at the predetermined soaking temperature for the prescribed length of time; it decrea-

ses the furnace temperature at the prescribed rate, and it does not permit the temperature differential between the thinnest and thickest boiler sections to exceed a set amount, 37 1/2 deg. in this instance. In addition to four thermocouples attached to the boiler for temperature control and two used at the thickest and thinnest boiler-plate sections for temperature-differential control, eight thermocouples are available for recording temperatures.

After stress-relieving the shell, the inside firebox, flues and tubes are installed and the boiler is given hydrostatic and hammer tests. The hydrostatic test is made with a pressure one and a half times that for which the boiler was designed. To pass this test the boiler must be absolutely tight.

[385. (09.2]

OBITUARY.

Alfred M. M. VERKOYEN,

Former Deputy General Manager of the Belgian National Railways Company.
Former Member of the Permanent Commission of the International Railway Congress Association.

It is with the greatest regret that we have to announce the death of M. Alfred VERKOYEN, former Deputy General Manager of the Belgian National Railways Company and former member of the Permanent Commission of our Association, who died suddenly at the beginning of this year.

M. Alfred Verkoyen was born at Linckhout (Limbourg) on the 20th June 1878. After a brilliant scholastic career at the University of Liége, he obtained his Diploma of Civil Mining Engineer in 1903. Two years later, on the 8th June 1905, he entered the service of the Belgian State Railways. He worked first of all in the Gentbrugge Central Shops, then at Berchem. In 1911, he was put in charge of the Carriage Department at Brussels Q. L. Two years later, he was attached to the Stores Receipts Office at Liége.

In 1920 he was appointed head of the Liége district « Traction & Rolling Stock », and on the 3rd January 1922, the State Railway Administration put him in charge of the Central Shops at Louvain. In this capacity he was able to make the fullest use of his remarkable gifts of organisation by introducing a policy which led to the scientific organisation of the work on the belt system.

In recognition of his talents, the Belgian National Railways Company put him in charge of the largest shops on the system, the Malines Central Shops.

In 1933, M. Verkoyen was appointed Manager of the Rolling Stock Department; in this post he was able to make the fullest use of his talents, and all

those who worked with him know with what thoroughness and scientific exactness he studied all the problems put before him.

On the 1st January 1942, he was appointed Deputy General Manager, and in 1945, when the country was liberated, the Belgian Government invited him to become President of the Permanent Committee of the Belgian National Railways Company. When he reached the age of retirement in November 1945, he was, with the enthousiastic agreement of the Government and the Belgian National Railways Company, charged with maintaining direct relations between the Department of Communications and the Company.

M. Alfred Verkoyen fulfilled all the duties entrusted to him with the greatest intelligence, complete disinterestedness, and a keen sense of reality. We quote below the words of the Belgian Minister of Communications spoken about the deceased at a Meeting of the Administrative Council of the Belgian National Railways Company :

« He had a great love for his chosen calling, without however neglecting other aspects of human activity. On all subjects his views were expressed with great originality, but always with a respect for the truth. His geniality hid a very strong will, and during the occupation he never failed to carry out what he considered to be his duty. »

M. Verkoyen was elected a member of the Permanent Commission of the Association in 1933, and always took the greatest interest in its work. He took part, in particular, at the technical meetings of the enlarged meeting of the Permanent Commission in Brussels in 1935 and 1939.

We offer his family our sincere sympathy. *The Executive Committee.*

Adolphe BRAEM,

Former Director of the Belgian State Railways.

Former Member of the Permanent Commission, and Administrative Councillor of the International Railway Congress Association.

Amongst the eminent personalities of the Belgian Railways who died during the war, obituary notices of whom were published in the first numbers of our *Bulletin,* mention must be made of our former colleague M. Adolphe Braem, former Director of the Belgian State Railways and Administrative Councillor of our Executive Committee from 1919 to 1929.

M. Adolphe Braem was born at Saint-Josse-ten-Noode on the 17th March 1864. After a brilliant scholastic career, he entered the Belgian State Railways where he was destined to have a lengthy and brilliant career, starting on the bottom rung and ending up right at the top. He distinguished himself from the start by his zeal and devotion to duty under all circumstances. Promoted Chief Clerk in 1897, he also took over the duties of Secretary of the Committee for

standardizing the regulations applying to all the staff of the department and those of private secretary to the General Secretary. In all these capacities, he always showed his sound judgment, perspicacity, strong and flexible aptitude, initiative and capacity for hard work.

On the 30th December 1902, he was promoted Departmental Head, and took over the duties of Secretary to the Conference of the General Management of the Railways; in 1909 he became Head Office Inspector.

On the 31st January 1919 he was promoted Managing Director on account of the great services rendered not only to the State Railways Administration but also to his country during his sojourn at the Hague during the 1914-1918 war. On the 30th December 1919, he was appointed Inspector General and on the 19th January 1923, Manager of the Belgian State Railways.

In 1928, his competence and thorough experience made him a suitable choice for the post of Counsellor for the General Management of the Belgian National Railways Company.

He retired on the 1st April 1929.

M. Braem was nominated member of the Permanent Commission in 1922. He rendered very great services to the Association during the First World War. In 1916, when he was Secretary to the Management Committee of the Belgian State Railways and Delegate of the Railway Ministry for the Belgian legation at The Hague, M. Braem agreed to undertake the duties of assistant secretary-treasurer to the Association and to watch over its interest abroad.

In 1919, owing to the demands of his work on the Management Committee of the Belgian State Railways, M. Braem was obliged to give up his work as assistant secretary-treasurer, and in gratitude for the services rendered by him to the Association, the Executive Committee of the Permanent Commission appointed him Administrative Counsellor of the Committee on the 13th December 1919.

M. Braem represented the Ministry of Railways, Marine, Posts and Telegraphs of Belgium and the Belgian State Railways at the Rome (1922) and London (1925) Sessions, and also took part, in his capacity of Administrative Counsellor at the Madrid Session in 1930.

On his retirement in April 1929, he gave up his place on the Permanent Commission but continued to collaborate in the work of the Association until after the Madrid Session.

M. Braem always had the interests of the Association very much to heart, and was keenly interested in all its work.

We will always remember our devoted colleague.

The Executive Committee.

NEW BOOKS AND PUBLICATIONS.

[385. 02]

The Universal Directory of Railway Officials and Railway Year Book, 1946-1947. — London : The Directory Publishing Company Limited, 33, Tothill Street, Westminster, S. W. 1., 588 pages, 8 1/2 in. × 5 1/2 in. (Price : 20 sh. net.).

The Universal Directory of Railway Officials originally issued in 1895, reaches with the present volume its 52nd year of publication.

Rapid restoration of railway facilities, and of civil administration, in many parts of the world have resulted in the resumption of commercial traffic over wide areas. In consequence, the present edition has received more revision from official sources in various overseas countries than has been practicable during the past six years.

The new edition should prove very valuable to railway officers and others to keep in touch with the personnel on railways throughout the world for the exchange of information concerning research and developments in all phases of railway operation and maintenance.

For ready reference purposes, at the end of the volume will be found three indexes namely :

1) an index to countries;

2) a general index, including all reference to railways and statistical and other information;

3) a personal index of railway officials.

MONTHLY BIBLIOGRAPHY OF RAILWAYS[1]

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(OCTOBER 1946)

16. 385. (02]

I. — BOOKS.

In French.

6 **62. (02**

S-PAPIN (M.) et VALLOT (J.).
rologie générale (Grandeurs et unités). Aide-
re Dunod.
s (6e), Dunod, éditeur, 92, rue Bonaparte. 1 vol.
15 cm.) de 428 pages, avec 54 figures. (Prix,
240 fr. français.)

6 **625 .258**

UX (Ch.).
le théorique et expérimentale des freins de voie
à mâchoires).
s, Bibliothèque de l'Ecole polytechnique. 1 volume
é (18.5 × 27) de 76 pages.

4 **656 .136**

olleybus.
s, Dunod, éditeur, 92, rue Bonaparte. 1 volume
25 cm.) de VI-131 pages et 167 figures. (Prix:
français.)

6 **669**

x non ferreux.
s, éditeur: Presses Documentaires (Maison de la
e), 28, rue Saint-Dominique. 1 brochure (21 × 27)
pages. (Prix: 100 fr. français.)

5 **623 (.44)**

STERE DE LA GUERRE (France). Etat-major de
rmée. Bureau scientifique de l'armée.
bombardements aériens des Chemins de fer fran-
e janvier à août 1944. Analyse de leurs effets.
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onts. 3e fascicule: La traction. 4e fascicule: Le

s, 90, rue de Courcelles. 4 brochures (310 × 235)
nsemble de 205 pages, avec 73 figures.

6 **656 .2**

(J.).
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t transport.
s, Editions Léon Eyrolles. 1 vol. in-8o (16 ×25 cm.)
pages, avec illustrations.

In German.

1943 **385. (09 .3 (.494)**

MATHYS (E.).
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Bern, Selbstverlag des Verfassers. 1 Band, 300 Seiten.

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1946 **621 .13 (09 (.42)**

ALRICH (L. C.).
Great Eastern locomotives, past and present (1862-1945).
London: published by E. Y. Alrich, 104, Grove Crescent, N. W. 9 (8 3/4 in. × 5 1/2 in.), 112 pp., 63 illustrations. (Price: 8 sh.).

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British locomotive types. (Sixth edition).
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1946 **535**

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JOHNSON (F.).
Metal working and heat treatment manual, Vol. I.
London: Paul Elek (Publishers) Ltd. 36-38, Hatton Gardens, E. C. 1. (Price: 17 sh. 6 d.)

1946 **385**

MONKSWELL (Lord).
Railways and their future.
London: Ernest Benn Ltd., Bouverie House, Fleet Street, E. C. 4. (Price: 3 sh. 6 d. net.)

1946 **385. (09 (.42)**

NASH (G. C.).
The L. M. S. at war.
London: Published by the L. M. S. Railway. (Price: 5 sh.)

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[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress con- with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

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A series of articles to commemorate **the 100th anniversary of the Pennsylvania Railroad** (135 pages with many illustrations).

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II. — PERIODICALS.

In French.

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Annales des Mines et des Carburants, février, p. 172.

VICHNIEVSKY (R.). — Les études expérimentales du **moteur à deux temps** à l'étranger. (10 000 mots & fig.)

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de GRAVE (A.) & DEMOUSTIEZ (W.). — Lignes d'influence des moments aux appuis de **poutres continues sur appuis élastiques** à 2, 3, 4 et 5 travées égales. (5 000 mots & fig.)

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DURAND (P.). — La **notion de faute lourde** du voiturier et la guerre. (5 000 mots.)

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Bull. des transp. intern. par ch. de fer, décembre, p. 421.

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Les **Chemins de fer** suédois en 1942. (Tableaux.)

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DURAND (P.). — Contribution à l'étude sur la sit tion juridique de certaines **gares frontières.** (2 000 mo

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EGER (G.). — La publication des **mesures de t internationales.** (4 000 mots.)

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946 **621 .31 (.494)**
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ARDIOL (E.). — Le grand **viaduc** du bois des Che- sur le chemin de fer du Montreux-Oberland bernois. 00 mots & fig.)

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Quelques nouvelles **locomotives et automotrices électriques.** Electrifications récentes. (1 200 mots & fig.)

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1946 **621 .392**
Electricité, n° 115, avril, p. 79; n° 116, mai, p. 113.
SALELLES (R.). — Le **soudage électrique par résistance.** Machines électriques à souder. (4 500 mots & fig.)

Génie Civil. (Paris.)

1943 **621 .89**
Génie Civil, n° 3104, 1er mars, p. 56.
Causes de l'oxydation, à l'usage, des **huiles de graissage** minérales. (2 200 mots.)

1943 **624 .63 (.460)**
Génie Civil, n° 3106, 1er avril, p. 74.
Le **viaduc en béton armé** Martin Gil de 210 mètres de portée sur l'Esla (en Espagne). (2 500 mots & fig.)

1943 **697**
Génie Civil, n° 3106, 1er avril, p. 77.
Le **chauffage thermodynamique.** (2 500 mots.)

1943 **625 .143 .2**
Génie Civil, n° 3106, 1er avril, p. 78.
MERKLEN (J.) & VALLOT (E.). — La fabrication et les conditions de recette des **aciers au carbone.** (1 500 mots & fig.)

1943 **62. (01**
Génie Civil, n° 3106, 1er avril, p. 79.
La **mesure pneumatique** des très faibles **déplacements.** Le **micromètre Solex.** (1 500 mots & fig.)

1943 **625 .42 (.44)**
Génie Civil, n° 3108, 1er mai, p. 97.
MARTELLI. — La ligne n° 5bis « Gare du Nord-Eglise de Pantin » du **Chemin de fer Métropolitain** de Paris. (1 900 mots & fig.)

1943 **662**
Génie Civil, n° 3108, 1er mai, p. 99; n° 3109, 15 mai, p. 112.
BERTHELOT (Ch.). — L'alcool **carburant.** (7 000 mots.)

1943 **621 .435**
Génie Civil, n° 3108, 1er mai, p. 102.
SERRUYS (M.). — Calcul du profil d'une chambre de combustion de **moteur à explosion** en vue d'obtenir une variation de pression donnée. (600 mots & fig.)

1943 **621 .132 .8 (.494) & 621 .438 (.494)**
Génie Civil, n° 3109, 15 mai, p. 109.
CALFAS (P.). — La nouvelle **locomotive de 2200 ch. à turbine à gaz** et transmission électrique des Chemins de fer fédéraux suisses. (2 500 mots & fig.)

1943 **62. (01 & 624 .2**
Génie Civil, n° 3110, 1er juin, p. 125.
JANSON (G.). — Nomogramme pour le calcul des sections de certaines **poutres en béton armé.** (1 000 mots & fig.)

1943 **625 .42 (.44)**
Génie Civil, n° 3111, 15 juin, p. 133.
MARTELLI (M.). — L'état actuel du réseau du **Chemin de fer Métropolitain** de Paris et les travaux récemment exécutés. (2 500 mots & fig.)

1943 **62. (01 & 624 .2**
Génie Civil, n° 3112, 1er juillet, p. 145.
FERRANDON (J.). — **Poutres** gauches à section constante et à fibres parallèles. (2 000 mots & fig.)

1943 **621 .89**
Génie Civil, n° 3112, 1er juillet, p. 152.
Les **huiles de graissage de remplacement** extraites de l'huile anthracénique brute. (1 200 mots.)

1943 **62 .(01 & 721 .4**
Génie Civil, n° 3114, 1er août, p. 172.
RAINETEAU (R.). — Propriétés des **arcs** non fléchis et d'égale résistance. (1 000 mots & fig.)

1943 **621 .132 .3 (.43)**
Génie Civil, n° 3114, 1er août, p. 175.
Locomotive à vapeur type l'Dol', système Henschel, à commande individuelle des essieux. (1 000 mots & fig.)

1943 **621 .132 .3 (.44) & 621 .132 .5 (.44)**
Génie Civil, n° 3115, 15 août, p. 181.
CALFAS (P.). — La **nouvelle locomotive 141-P** à vapeur de la Société Nationale des Chemins de fer français. (5 000 mots & fig.)

Mécanique (Bulletin de la Société française des Mécaniciens) (Paris).

1946 **669 .1**
Mécanique, n° 331, mars, p .81.
Le **traitement isothermique de l'acier.** (1 000 mots & fig.)

1946 **621 .82**
Mécanique, n° 332, avril, p. 101.
Applications des **roulements à billes, à rouleaux et à aiguilles.** (1 200 mots & fig.)

1946 **62. (01 & 621 .9**
Mécanique, n° 333, mai, p. 113; n° 334, juin, p. 145.
FARRENQ (R.). — Etude des efforts de coupe par la **méthode piézo-électrique.** (4 000 mots & fig.)

Revue de l'Aluminium (Paris).

1945 **6**
Revue de l'Aluminium, n° 113, juillet, p. 4.
VACHET (P.). — Quelques récents progrès de métallurgie des **alliages légers.** (5 000 mots & fig.)

1946 **6**
Revue de l'Aluminium, n° 120, mars, p. 77.
DUMAS (A.). — Situation actuelle et perspectiv d'avenir de l'industrie des **métaux légers.** (4 000 m & tableaux.)

Revue de l'Association française des Amis des Chemins de fer. (Paris.)

1946 **625 .62 (.49**
Revue de l'Ass. fr. des amis des Ch. de fer, n° 137, j vier-février, p. 1.
CAIRE (D.). — Les **tramways** municipaux de Zur (3 500 mots & fig.)

1946 **656 .222**
Revue de l'Ass. fr. des amis des Ch. de fer, n° 138, m avril, p. 25.
Baron VUILLET. — Les **vitesses les plus élev** atteintes sur la voie ferrée depuis l'origine par les lo motives à vapeur. (6 000 mots, tableaux & fig.)

1946 **621 .13 (09 (.**
Revue de l'Ass. fr. des amis des Ch. de fer, n° 138, m avril, p. 37.
VILAIN (L.-M.). — Les **anciennes locomotives mix et à marchandises système Camille Polonceau** de la C pagnie d'Orléans (1854-1858). (2 000 mots, tableaux & f

Revue générale des chemins de fer. (Paris

1943 **621 .13**
Revue générale des chemins de fer, n° 6, novem décembre, p. 129.
CHAN & GALIBOURG. — Vieillissement des t de **chaudières.** (3 000 mots, tableaux & fig.)

1943 **624 .63 (.**
Revue générale des chemins de fer, n° 6, novem décembre, p. 137.
OUDOTTE & CAYLA. — **Reconstruction du viadu Longeray** P. K. 140.147 de la ligne de Bellegard Saint-Gingolph. (3 000 mots & fig.)

1943 **625**
Revue générale des chemins de fer, n° 6, novem décembre, p. 143.
CLEYET-MICHAUD. — **Etude thermique des p chers** de voitures. (2 500 mots & fig.)

1943 **621 .431 .72 (**
Revue générale des chemins de fer, n° 6, novem décembre, p. 146.
Les **autorails alimentés au gaz naturel** de Saint-Ma (2 500 mots & fig.)

1943 **621 .33 (**
Revue générale des chemins de fer, n° 6, novem décembre, p. 151.
La **traction électrique** en U. R. S. S. (600 & cartes.)

1944 625 .213
vue générale des chemins de fer, n° 1, janvier-février, p. 1.
ORESTIER & LEJEUNE. — **Suspensions** amorties et ortisseurs. (6 000 mots & fig.)

1944 385 .517 (.44)
vue générale des chemins de fer, n° 1, janvier-février, p. 11.
LAMENT. — L'organisation de l'**éducation physique** les sports à la S. N. C. F. (3 000 mots & fig.)

1944 625 .3 (.44)
vue générale des chemins de fer, n° 1, janvier-février, p. 16.
ARTILLEUX (H.). — Le **Chemin de fer** du Mont-nc. (2 200 mots & fig.)

1944 621 .82 (.44) & 621 .134 .1 (.44)
vue générale des chemins de fer, n° 1, janvier-février, p. 19.
IVIERRE (G.). — Garnissage en couche mince des ssinets par le procédé centrifuge. (1 800 mots & fig.)

1944 624 .63 (.44)
vue générale des chemins de fer, n° 2, mars-avril, p. 25.
ÜDOTTE. — Reconstruction partielle et remise en du **pont** du Mée. (4 000 mots & fig.)

1944 656 .257 (.44)
vue générale des chemins de fer, n° 2, mars-avril, p. 30.
INOT. — Le **poste semi-autonome** de Songy. (2 000 s & fig.)

1944 621 .331 (.44)
vue générale des chemins de fer, n° 2, mars-avril, p. 33.
ASTINE. — Les nouvelles **sous-stations électriques** a ligne de Cerdagne. (2 000 mots & fig.)

1944 385 .587 (.44)
ue générale des chemins de fer, n° 2, mars-avril, p. 36.
ONGUEVILLE. — La **commande centralisée** des visi-s du matériel roulant. (2 600 mots & fig.)

1944 621 .433 (.44) & 656 .1 (.44)
ue générale des chemins de fer, n° 2, mars-avril, p. 41.
autocar rail-route système Talon. (1 000 mots & fig.)

1944 625 .24 (.44)
ue générale des chemins de fer, mai-juin, p. 49.
ORESTIER. — Programme d'avenir pour la con-tion des **wagons à marchandises.** (4 300 mots & fig.)

1944 624 .63 (.44)
ue générale des chemins de fer, mai-juin, p. 56.
AYLA. — Les **ponts-rails en béton armé** de la recon-tion de 1940. (3 000 mots, tableau & fig.)

1944 621 .131 (.44)
ue générale des chemins de fer, mai-juin, p. 61.
ELLARIN. — De la variation du **rapport des charges rquées au poids adhérent** des locomotives de grande se depuis 1871 jusqu'à nos jours et du **rapport du s de ces locomotives aux charges remorquées.** (3 000 & fig.)

Revue universelle des Mines. (Liége.)

1945 625 .143 .1 (.493)
Revue universelle des Mines, 15 décembre, p. 213.
LEMAIRE (C.). — **L'évolution du rail standard** des Chemins de fer belges. (3 000 mots, tableaux & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1942 385 (09 (.436)
Archiv für Eisenbahnwesen, September-Oktober, S. 657.
PRANG (A.). — Die **Donau-Save-Adria Eisenbahn-Gesellschaft** (vormals Südbahn-Gesellschaft) im neuen Kleid (6 500 Wörter.)

1942 385 (09 (.436)
Archiv für Eisenbahnwesen, September-Oktober, S. 669.
Die **Entwicklung der Donau-Save-Adria Eisenbahn-Gesellschaft** vom Ende des Weltkriegs bis Anfang 1938. (13 000 Wörter.)

1942 385 (.47) & 656 .2 (.47)
Archiv für Eisenbahnwesen, September-Oktober, S. 697.
GARBE (Georg). — Die **russische Verkehrswirtschaft** unter dem Sowjetregime. (8 000 Wörter & Tafeln.)

1942 385 (091 (.94)
Archiv für Eisenbahnwesen, September-Oktober, S. 721.
WERNEKKE. — **Quer durch Australien mit der Eisenbahn** (Die Australische Quereisenbahn und ihre Anschlussbahnen. (8 500 Wörter & Abb.)

1942 385 (091 (.94)
Archiv für Eisenbahnwesen, September-Oktober, S. 743.
KANDAOUROFF (P.). — Die **Australischen Eisenbahnen.** (5 000 Wörter, 15 Tafeln & 1 Karte.)

1942 385 .5 (.43)
Archiv für Eisenbahnwesen, November-Dezember, S. 825.
GLIEM (A.). — Die Entwicklung des **Eisenbahn-Arbeitsrechts.** (22 000 Wörter.)

1942 385 .15 (.43)
Archiv für Eisenbahnwesen, November-Dezember, S. 875.
BECKER (W.). — Die Entwicklung des Gedankens der **Verstaatlichung der Eisenbahnen in Deutschland** und seine Durchführung in der deutschen Eisenbahnpolitik. (20 000 Wörter.)

Der Bahn-Ingenieur. (Berlin.)

1941 621 .133 .2
Der Bahn-Ingenieur, Nr. 6, 9. Februar, S. 65.
URBANEK (J.). — Bewegliche **Stehbolzen.** (1 700 Wörter & Abb.)

1941 621 .138 .5 (.43)
Der Bahn-Ingenieur, Nr. 7, 16. Februar, S. 79.
Aufteilung und Einrichtung einer neuzeitlichen **Drehgestellwerkstatt.** (800 Wörter & Abb.)

1941 625 .144 .2 & 625 .151
Der Bahn-Ingenieur, Nr. 10, 9. März, S. 113.
WARNICK (A.). — **Überhöhungen und Untertiefungen** in Gleisen und Weichen nach den neuen Oberbauvorschriften. (3 500 Wörter & 6 Tafeln.)

1941 **625 .235**
Der Bahn-Ingenieur, Nr. 12, 23. März, S. 137; Nr. 13, 30. März, S. 149.
ARPE (Chr.). — Der **Anstrich der Eisenbahnfahrzeuge.** Herstellung, Erhaltung, Reinigung. (9 000 Wörter & Abb.)

1941 **625 .113 (.43)**
Der Bahn-Ingenieur, Nr. 15, 13. April, S. 176.
JAEHN. — **Bogenwechsel ohne Übergangsbogen** sowie Gegenbogen ohne Übergangsbogen nach den neuen Oberbauvorschriften. (1 700 Wörter.)

1941 **621 .8 (.43)**
Der Bahn-Ingenieur, Nr. 15, 13. April, S. 179.
WÜST (J.). — Elektrische Ausrüstung von **Hebebockanlagen.** (1 700 Wörter & Abb.)

1941 **625 .153**
Der Bahn-Ingenieur, Nr. 16, 20. April, S. 185.
WUNDENBERG. — **Bogenkreuzungen** und **Bogenkreuzungsweichen.** (2 000 Wörter & Abb.)

1941 **62. (01 & 625 .213**
Der Bahn-Ingenieur, Nr. 16, 20. April, S. 190.
Neuartige **Federprüfmaschinen.** (1 000 Wörter & Abb.)

1941 **691 (.43)**
Der Bahn-Ingenieur, Nr. 17, 27. April, S. 197.
FLEISCHMANN. — **Werkstoffverwendung** früher und heute. Verwendung von Heim- und Altstoffen. (1 700 Wörter, 1 Tafel & Abb.)

1941 **625 .214**
Der Bahn-Ingenieur, Nr. 20, 18. Mai, S. 233.
SCHINKE. — Wie werden die **Lagerschalen der Eisenbahnfahrzeuge** im Betrieb beansprucht und wie sollen sie in der Werkstatt aufgeweitet werden? (1 600 Wörter & Abb.) (Siehe Erwiderung zu diesem Aufsatz: « Bahn-Ingenieur », Nr. 37, 14. September 1941, S. 441.)

1941 **625 .113**
Der Bahn-Ingenieur, Nr. 20, 18. Mai, S. 236.
MATZ. — Zeichnerische Ermittlung von **Schnittpunkten und Pfeilhöhen.** (900 Wörter & Abb.)

1941 **621 .132 .1 (.6)**
Der Bahn-Ingenieur, Nr. 24, 15. Juni, S. 281.
SCHROETER (H.). — Neuere afrikanische **Lokomotiven.** (1 000 Wörter, 1 Zahlentafel & Abb.)

1941 **625 .214 (.43)**
Der Bahn-Ingenieur, Nr. 24, 15. Juni, S. 288.
BÖHME. — Die **Stahlbleibronze-Wagenlagerschale** und ihre Bearbeitung. (1 200 Wörter & Abb.)

1941 **625 .151 (.43)**
Der Bahn-Ingenieur, Nr. 25, 22. Juni, S. 293.
SIEGLE. — Verbesserungsvorschläge für die **Reichsbahnweichen** 49-190-1 : 9/1 : 7.5/1 : 6. 6. (2 500 Wörter & Abb.)

1941 **621 .133 .4**
Der Bahn-Ingenieur, Nr. 26, 29. Juni, S. 311; Nr. 41, 12. Oktober, S. 489.
LINDER (R.). — **Windleitbleche** an Dampflokomotiven. (800 Wörter & Abb.) (Siehe Erwiderung von KOCH (K.) zu diesem Aufsatz in Nr. 41.)

Elektrische Bahnen. (Berlin.)

1942 **621 .3**
Elektrische Bahnen, Heft 8, August, S. 161.
WEICKER (W.). — Die **Fahr- und Fernleitungs-Isolatoren** der Deutschen Reichsbahn. (4 500 Wörter & Abb.)

1942 **621 .3**
Elektrische Bahnen, Heft 8, August, S. 167.
ZARN (W.). — Der **Fahrdrahtglätter.** (4 000 Wörter & Abb.)

1942 **621 .335 (.43) & 621 .392 (.4**
Elektrische Bahnen, Heft 8, August, S. 177.
REITER (M.). — Das **geschweisste Fahrgestell** der **elektrischen Güterzuglokomotive** Co' Co' E 94 der Deutschen Reichsbahn. (2 500 Wörter & Abb.)

1942 **621 .332 (.4**
Elektrische Bahnen, Heft 9, September, S. 177.
WILKE (G.). — **Kurzschlussströme im Reichsbahnfahrleitungsnetz,** ihre Begleiterscheinungen und deren Bekämpfung. (8 000 Wörter & Abb.)

1942 **621**
Elektrische Bahnen, Heft 10, Oktober, S. 199.
KOTHER (H.). — Zur **Energiewirtschaft elektrischer Grossbahnen.** Eine Studie über den Einfluss von Streckenbelastung und Fahrleitungsspannung auf Zahl, Leistung und Arbeitsverbrauch von Kraft- und Unterwerken. (12 000 Wörter, 2 Tafeln & Abb.)

1942 **621 .33 & 625 .**
Elektrische Bahnen, Heft 11, November, S. 221.
KOTHER (H.). — **Grenzleistungen des Verkehrs der Schmalspurbahn bis zur Breitspurbahn.** (3 500 Wörter, 9 Tafeln & Abb.)

1942 **621 .335 (.494) & 625 .231 (.4**
Elektrische Bahnen, Heft 11, November, S. 228.
STEINER (F.). — Brünig- **Gepäcktriebwagen** Fhe Nr. 901-916. (2 500 Wörter, 1 Tafel & Abb.)

1942 **621 .335 (.4**
Elektrische Bahnen, Heft 11, November, S. 233.
LIECHTY (R.). — Ein interessanter **Umbau 2 500 PS-Lokomotiven** der Lötschbergbahn. (500 Wö & Abb.)

1942 **621**
Elektrische Bahnen, Heft 11, November, S. 235.
KASPEROWSKI (O.). — **Schichtbürsten** im Betr (3 500 Wörter & Abb.)

Glasers Annalen. (Berlin.)

1942 **625**
Glasers Annalen, Heft 7, 1. April, S. 65.
MARSCHALL (A.). — Neuere Gesichtspunkte Entwurf von **Eisenbahn-Triebfahrzeugen.** (3 000 W & Abb.)

1942 **625**
Glasers Annalen, Heft 8, 15. April, S. 75.
WEISS (W.). — Fertigung vierachsiger **Leichtkwagen** von 63 cbm. Fassungsvermögen (1 900 W & Abb.)

942 625 .211
sers Annalen, Heft 8, 15. April, S. 79.
ÜNKLER (A.). — Das räumliche Fachwerk als **genunterspannung.** (1 800 Wörter, 1 Tabelle & Abb.)

942 621 .134 .2
sers Annalen, Heft 9, 1. Mai, S. 90.
CHÖNING (F. W.) & SCHÖNING (P.). — **Heu-er-Steuerung** mit angenäherter Stephensonscher Cha-eristik. (6 000 Wörter & Abb.)

942 621 .135. (01
sers Annalen, Heft 10, 15. Mai, S. 108.
EESEN (F.). — **Theorie und Praxis.** (2 500 Wörter bb.)

942 621 .335 (.494)
sers Annalen, Heft 11, 1. Juni, S. 116.
CHMELZER (K.). — **Elektrische Leichttriebfahr-ge** zur Beförderung von Leichtschnellzügen. (3 000 rter & Abb.)

942 621 .132 .3 (.497 .2)
sers Annalen, Heft 12, 15. Juni, S. 132.
EYER (E.). — **2'C'1'-Dreizylinder-Schnellzuglokomotiven** Baureihe 07 der Bulgarischen Staatsbahnen. 00 Wörter & Abb.)

942 62. (01
sers Annalen, Heft 13, 1. Juli, S. 137; Heft 14, 15. Juli, S. 149.
ÄNCHEN (R.). — Berechnung einfacher **Maschinen-** auf Dauerhaltbarkeit. (14 000 Wörter, 3 Tafeln, bb.)

942 621 .114
sers Annalen, Heft 15, 1. August, S. 161.
ÜTTGERDING (H.). — Die Knicksicherheit von lerseits getragenen **Kolbenstangen.** (2 000 Wörter bb.)

Die Lokomotive. (Bielefeld-Berlin.)

942 621 .134 .5
Lokomotive, Nr. 6, Juni, S. 89.
URMEISTER (E.). — **Stangenlager-Umlaufschmie-g.** (2 500 Wörter & Abb.)

942 621 .135 .4
Lokomotive, Nr. 6, Juni, S. 99.
laufeigenschaften der Lokomotiven. (1 700 Wörter.)

942 621 .134 .5
Lokomotive, Nr. 6, Juni, S. 101.
CHNEIDER (L.). — Amerikanische Einstellung zur **omotivschmierung.** (1 500 Wörter.)

942 621 .131 .2
Lokomotive, Nr. 7, Juli, S. 107.
WALD (K.). — Dampflokomotive und **Vereinheit-ung.** (4 000 Wörter & Abb.)

942 621 .13 & 665 .882
Lokomotive, Nr. 7, Juli, S. 113.
ENGLER. — Das **Oberflächenhärten von Lokomotiv-n** mittels Leuchtgas. (4 500 Wörter & Abb.)

1942 621 .431 .72 (.437) & 621 .433 (.437)
Die Lokomotive, Nr. 7, Juli, S. 120.
Eisenbahntriebwagen der Böhmisch-Mährischen Bahnen mit **Holzkohlengasantrieb.** (1 100 Wörter & Abb.)

1942 621 .134 .1
Die Lokomotive, Nr. 8, August, S. 125.
KINKELDEI (L.). — Der **Einzelachsantrieb von Dampflokomotiven.** (2 400 Wörter & Abb.)

1942 621 .135 .4 & 625 .215
Die Lokomotive, Nr. 8, August, S. 129.
NÖTHEN (J.). — Beitrag zur **praktischen Anwendung des Minimumverfahrens.** (7 000 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens. (Berlin.)

1941 656 .257 & 656 .212 .5
Organ für die Fortschritte des Eisenbahnwesens, Heft 16, 15. August, S. 241.
SCHMITZ (W.). — **Selbsttätige Weichenstellung** im Ausland. (10 300 Wörter, 2 Zusammenstellungen & Abb.)

1941 385 (.55)
Organ für die Fortschritte des Eisenbahnwesens, Heft 16, 15. August, S. 258.
Die **Eisenbahnen** Irans. (600 Wörter.)

1941 621 .133. (01
Organ für die Fortschritte des Eisenbahnwesens, Heft 17, 1. September, S. 239.
DENECKE (O.) & KOESSLER (P.). — Nachrechnung der **Heizflächen des Lokomotivkessels** üblicher Bauart (Stephensonkessel). (4 000 Wörter & Abb.)

1941 625 .23 (0
Organ für die Fortschritte des Eisenbahnwesens, Heft 18, 15. September, S. 275.
von WALDSTÄTTEN (K.) & MÜSSIG (W.). — Beitrag zur **Festigkeitsberechnung des Wagenkastens** für Eisenbahn-Personenwagen BC 4 üp. (4 500 Wörter & Abb.)

1941 625 .143 .4 & 625 .144 .1
Organ für die Fortschritte des Eisenbahnwesens, Heft 18, 15. September, S. 281.
MEIER (H.). — Wo bleibt das **lückenlose Eisenbahn-gleis?** (9 000 Wörter & Abb.)

1941 625 .13
Organ für die Fortschritte des Eisenbahnwesens, Heft 19/20, 1./15. Oktober, S. 293.
BLOSS. — **Tunnelbahnen** im Mittelgebirge und Hügelland. (6 000 Wörter & Abb.)

1941 625 .13 (.436)
Organ für die Fortschritte des Eisenbahnwesens, Heft 19/20, 1./15. Oktober, S. 300.
KARGL (F.). — **Tunnelbauten** der Ostmark. (11 000 Wörter & Abb.)

1941 625 .13 (.45)
Organ für die Fortschritte des Eisenbahnwesens, Heft 19/20, 1./15. Oktober, S. 317.
WERNEKKE (F.). — Italienische **Tunnel.** (8 500 Wörter & Abb.)

1941 **625 .13 (.485 + .489)**
Organ für die Fortschritte des Eisenbahnwesens, Heft 19/20, 1./15. Oktober, S. 328.
FLENSBORG. — **Eisenbahn- und Strassentunnel** unter dem Oresund zwischen Dänemark und Schweden. (1 500 Wörter & Abb.)

Die Reichsbahn. (Berlin.)

1943 **656 .254 (.44)**
Die Reichsbahn, Heft 16-17, 21./28. April, S. 113.
WÖCKE. — Einrichtung des **Dispatching-Systems** der Südwestregion der S. N. C. F. als Mittel der Betriebsführung und- überwachung. (3 500 Wörter & Abb.)

1943 **385 .113 (.43)**
Die Reichsbahn, Heft 24-26, 16./23./30. Juni, S. 161.
Geschäftsbericht der Deutschen Reichsbahn über das Geschäftsjahr 1942. (1. Januar bis 31. Dezember 1942). (5 000 Wörter & 2 Tabellen.)

1943 **621 .137 & 621 .138**
Die Reichsbahn, Heft 29-30, 21./28. Juli, S. 187; Heft 31-32, 4./11. August, S. 198.
FISCHER (W.). — Mehr Achtung vor der Lokomotivstunde! Ein Weg zur **Stärkung des Zuglokomotivparks.** (5 500 Wörter & Abb.)

1943 **625 .62 (.43) & 656 .261 (.43)**
Die Reichsbahn, Heft 33-34, 18./25. August, S. 209.
VÖLCKER. — **Expressgutzustellung** mit Strassenbahn. (1 600 Wörter & Abb.)

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TOMS (A. H.). — « **Hunting** » **of railway r stock and locomotives.** (1 800 words & fig.)

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DERENS (L.). — The **Dutch State Railway** (1 500 words & fig.) (To be continued.)

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Wrecking Netherlands railways. Sack and ransack. The tale of German destruction. (800 words & fig.)

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Slower-running engines for Diesel locomotives. (360 words & fig.)

1946 **621 .431 .72 (.73)**
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MANN (Ch. F. A.). — U. S. A's largest **single car locomotive.** (650 words & fig.)

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MANN (Ch. F. A.). — Special **maintenance facilities** for railway Diesel-engined rolling stock. (1 800 words & fig.)

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Shunting tractors for Finnish railways. (740 words & fig.)

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1946 **656 .254 (.73)**
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Radio warning tested on Seaboard. (900 words & fig.)

1946 **656 .257 (.73)**
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Five **interlockings** at Norfolk. (1 500 words & fig.)

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1946 **725 .31 (.42)**
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1946 **621 .138 .5 (.73)**
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1946 **656 .281 (.42)**
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Ministry of War Transport **accident report:** Bourne End, L. M. S. R., September 30, 1945. (4 200 words.)

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1946 **621 .132 .3 (.73)**
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High-speed locomotives for the Pennsylvania Railroad. Four cylinders drive two independent sets of four-coupled wheels 100 m. p. h. with 1 000 ton load. (2 000 words & fig.)

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1946 **656 .285 (.42)**
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1946 **625 .1 (09**
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TOWERS (H. C.). — **Level-crossing interlocki**
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1946 **621 .138 .5**
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New motive power shed at Carnforth, L. M.
(800 words & fig.)

1946 **625 .142 .3**
Railway Gazette, No. 16, April 19, p. 429.
British **metal plate sleepers.** (1 500 words & fig.

1946 **621 .132 .3**
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Four-cylinder Duplex locomotive for the Pennsy
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1946 **656 .253**
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replaces former wooden structures. (500 words & f

1946 **625 .14 (.42) & 656 .25**
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Points of contact between permanent way and
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Radio-frequency crack detector. (800 words & f

1946 **62**
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Rhine **railway bridges** in the British zone. (1 100
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1946 **656 .28**
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Ministry of War Transport **accident report:** C
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L. M. S. R. **commercial organisation.** (900 wor

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Locomotive limitations. (2 500 words.)

1946 **6**
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A neglected point in **switch design.** (1 600 words

1946 **625 .1**
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Unusual tunnel rebuilding. A 528-ft. length
double-line tunnel has been recrowned from abo
a vertical shaft and headings along the ridge of
crown. (1 500 words & fig.)

656 .254 (.71)
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621 .132 .3 (.73)
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n Pacific gets 20 more **4-6-6-4 steam locomotives.**
words & fig.)

621 .335 (.73)
y Mechanical Engineer, October, p. 420.
R (Charles), Jr. & ALBEN (F. L.). — The New
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SON (P. B.). — Reducing weight of **diesel road**
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TH (C. B.). — Some notes on **hot boxes.** (1 500
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built Milwaukee **passenger cars.** (4 000 words

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TH (W.). — **Steam distribution.** (4 000 words.)

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WART (C. D.). — **Braking high-speed trains.**
words & fig.)

621 .13
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CKER (W. T.). — The **steam locomotive.** (2 400

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turbine locomotives. (2 000 words & fig.)

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625 .243 (.73)
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Northern builds 1 000 **fifty-ton plywood box cars.**
words & fig.)

1944 **621 .132 .5 (.73)**
Railway Mechanical Engineer, August, p. 349.
C. & O. **2-8-4 locomotives.** (1 200 words & fig.)

1944 **625 .245 (.485)**
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ANDERSON (A.). — **All-welded tank cars.** (500 words & fig.)

1944 **656 .254 (.73)**
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CAMACHO (G.). — Los **Ferrocarriles nacionales de Colombia.** (4 000 palabras & graficos.)

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1945 **385 .113 (.82)**
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NUNEZ BRIAN (J.). — **Resultado de la explotación** de los ferrocarriles argentinos. (Ejercicio económico 1943-1944 y primer semestre 1944-1945). (900 palabras & cuadros.)

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GREVE (E.). — Historia de la ingenieria en Chile. Los **primeros ferrocarriles.** (7 000 palabras.)

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1945 **385. (09 (.87)**
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1945 **656 (.82)**
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1943 **621 .131**

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1943 **656 .2 (.47)**

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1943 **621 .392 & 625 .143**

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REINHART (W. M.). — La **soldadura aluminotérmica** en las vías ferroviarias. (1 600 palabras & fig.)

1943 **621 .332**

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La **elección de corriente** para la electrificación de lineas principales. (2 500 palabras.)

1943 **621 .131 .1**

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MARTINEZ de VALESCO (R.). — Algunas consideraciones sobre el aumento de **potencia específica de las locomotoras.** (1 500 palabras & fig.)

1943 **625 .2 : 625 .62 (.460)**

Ferrocarriles y Tranvías, marzo, p. 63.
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1943 **385 .113 (.494)**

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1943 **656 .257**

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1943 **62. (01 & 625 .212**

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1944 **385. (09**

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oorden & fig.)

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VAN DER MEIJ (G.). — De **sociale positie** van het personeel der Nederlandsche Spoorwegen. (4 500 woorden.)

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ZOETELIEF NORMAN (H.). — **Acetyleen-Ammoniakmengsels.** Nieuwe motorbrandstofmogelijkheden. (2 200 woorden & fig.)

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LABRIJN (P.). — De **locomotieven** van de N. B. D. S. (2 000 woorden & fig.)

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1942 656 .211 .5 (.492) & 656 .234 (.492)
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KARSKENS (J. J.). — **Zandstrooiers.** (1 500 woorden & fig.)

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JANSEN (W.). — Het gebruik van den **Telex.** (2 200 woorden & fig.)

1942 **621 .133 .2 & 621 .138 .5**
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VAN DEN BERG (J.). — Het lasschen en het uitvoeren van herstellingen aan **roodkoperen vuurkisten.** (2 000 woorden & fig.)

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1942 **656 (.494)**
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MOREAU (J. A. E. G.). — Materiaal en warmtebehandeling van **spoorrails.** (4 000 woorden & fig.)

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1942 **621 .335 (.492) & 621 .338 (.492)**
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